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Editorial Contents for January, 1930

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A Car Foreman Stops Slip-Shod Burning

SLIP-SHOD rivet burning can frequently damage a good sheet on a car going into the shop for heavy repairs sufficiently to prevent its being reapplied or even reclaimed. One general car foreman had occasion recently to check up the practice of his men who are burning rivets because of the large number of over-size rivets being used, and because of the number of cars going out of the shop with washers used under rivet heads to cover large holes. He questioned the men burning out rivets and was told that the men tearing down objected when they had to back out the rivets. They insisted on having the holes burned large enough so that the rivets would fall out. It did not take long for the general foreman to correct all misunderstanding. He assembled his burners, borrowed a torch and a pair of goggles, burnt the heads off six or eight rivets and explained how he wanted the work done. Since that time few over-sized rivets have been used, and no washers.

"It Can Be Done"

OCCASIONALLY we hear someone say that the use of slogans or quotations of the inspirational sort, with some such object as securing better observance of safety rules or to obtain improved departmental efficiency, is being overdone. Such an opinion may be justified on the part of those who have tried to secure something along the lines of inspirational effort through the use of slogans, but have only achieved half-hearted results. There should be little need to point out the fact, that the job of living up to a slogan applies no more to the rank and file than it does to the management. It cannot be a case of "Don't do as I do, but do as I tell you". Those in supervisory capacities cannot assume such an attitude and at the same time expect the men under them to give whole-hearted support.

A case in point, is that of the car department of an eastern railroad. The performance of this department has been the cause of editorial comment in these columns on several occasions. Deviating a little from the subject, it might not be out of place to say that during 1929, this particular road broke its previous records in having the lowest number of hot boxes in both freight and passenger service (no hot boxes were reported in passenger train service during the month of November, 1929), it had the lowest number of freight train detentions chargeable to the car department, established a new low record for overtime for the car department, and in addition bettered its record for 1928 in the number of cars receiving air-brake attention. With this improved performance, there was a net decrease for the year 1929 over 1928 in the expenses chargeable to Accounts 314, 317 and 326.

In 1927, the employees of this car department adopted the slogan "Aim high and strike hard". In 1928, the slogan was "Accuracy and speed", while the slogan last year was "Conserve-Achieve". Twenty-five slogans were submitted in the contest for a slogan for the department during 1930. Three of the contestants proposed the same slogan, "It can be done". This slogan was adopted.

As in previous years, numerical monthly and yearly quotas have been established by the car department for hot boxes in freight and passenger-train service, train detentions, cars reweighted, cars receiving air brake attention, etc. It is needless to say that the slogan "It can be done" will be in the minds of both supervisors and men, as they strive to meet their respective quotas during 1930. Faith in the fundamental honesty and idealism of one's fellow-workers is a big asset in running a railroad.

Investigate Journal-Packing Requirements

THE mechanical elements in the common car journal box which may contribute individually or in combination to "hot boxes" include the journal, brass, wedge, waste and oil. For the first three of these elements, the design, material, limits of wear and internal arrangement in the journal box to assure satisfactory performance have been rather definitely ascertained and are a matter of common knowledge. This is not

equally true with the other two elements, namely, waste and oil. The railroads have for years been attempting to use car-journal waste and oil with maximum efficiency, and much practical test data, supplemented by information based on service performance, is available. large numbers of hot boxes continue to develop, however, with the resultant expensive traffic delays and equipment repairs, due primarily to the lack of journal packing and lubricants exactly suited to the service requirements. There is a notable absence of scientific information regarding the individual characteristics of these materials which produce the best results when used in the journal box.

Economic conditions at the textile mills have had a tendency to depreciate the quality of waste available for use in car journal packing. There can be no question that, aside from the ability to conduct oil and remain in contact with the journal, waste should be devoid of free lint, have a fibre length and tensile strength within proper limits and present the least possible frictional resistance to the movement of the car journal. Moreover, the life of the material is an important consideration. It is said that some waste will depreciate 40 per cent a year, a fact which, in some instances, could be quite definitely determined by an inspection of the waste before being placed in service. A scientific study of waste characteristics and performance under varying conditions could hardly fail to net large returns in improved service.

Oils used for car-journal lubrication within the past few years have changed in general from paraffin to asphaltic base oils. How much is known about the conditions under which the oils now in use will give the best results? Definite data upon which the railroads can rely in purchasing car oil suitable to the specialized requirements seems to be more or less lacking. The present practice on many roads is to specify winter and summer grades of oil, yet the general impracticability of preventing car-journals packed with summer oil from going through into the winter, and vice versa, is admitted. The development of an oil for the specific purpose of car-journal lubrication which would serve effectively throughout the entire year, is another much-desired result which might be anticipated following a carefully supervised technical investigation.

Any scientific analysis of the performances of car journal waste and oil would require an accurate and reliable method of recording, during operation, the speed of the journals, the temperatures of the journal bearings and at various points in the packing underneath; also, if possible, the existing pressure on the bearing or the pressure to which the oil film is subjected, as well as some means of measuring the rate of supply of the oil film. Other questions would include the desirability of using rolls or plugs in the journal boxes; broaching the brasses; applying free oil; and many other practices common to railroad operation. In addition, the relative merits of new waste and new oil, renovated waste and renovated oil, and any combination of the two should be set up, together with the physical characteristics of waste and oil necessary to meet service conditions as they exist today.

There can be no doubt of the need for a scientific research to provide additional basic and reliable information about car-journal lubrication. It is almost equally certain that the railroads themselves should not attempt to make this research because research investigations are not primarily a railroad function and the roads have not the organization, experience or equipment necessary. Moreover, their test departments are already over-burdened with routine material investigations and test work. Any organization, therefore, which can develop the machinery and impartial test methods necessary for a scientific investigation of present journal box troubles, will perform a service of no mean value to the railroads.

A Trained Man's Job

TO those in the mechanical department who have concerned themselves with the many interesting phases of railway operation beyond the ones with which they may be intimately associated, the conclusion has already been reached that the biggest job that a railroad supervisor has before him is to get more service out of equipment at a reduced cost of operation. A railroad's revenue is a factor over which it has very little control and in order to make a profit from operations ways must be continually discovered to reduce the cost of operation. In the past few years both the car and the locomotive departments have been able, by increased efficiency, to effect material savings in the unit costs of equipment maintenance. Has the limit been reached?

The cost of locomotive repairs still constitutes the largest single item of locomotive operating expense and therefore the improvement of locomotive maintenance methods should present the greatest opportunities for effecting further economies. Along just what lines should further progress in the improvement of maintenance methods be expected—from the workman, the foreman or some as yet unorganized agency? Other industries have established shop-engineering or "production"-engineering departments the sole duties of which are to study the methods used in performing work and to recommend changes in facilities or methods which will result in a more economical operation. Some roads have already made a more or less half-hearted attempt to organize such departments by assigning one or two men to a large shop to study methods and then neglecting to give these men the authority or contact that would permit them to be of any real value to the company. The truth is that on most roads the supervisory organization is looked to and expected to produce all of the new ideas relating to shop practice when in most cases they have about all they can do to hold down their jobs as foremen in the face of the increasing demands that are being made upon them. Most foremen have many good ideas in the course of a day's work which are never worked out because of a lack of time, and as a result the road loses the benefit of the ideas of these men because it has provided no men or department whose sole duty it is to carry these ideas through to completion.

How many shop or enginehouse foremen can remember instance after instance where parts have failed in service in locomotives and cars and the fact has been reported, with the suggestion that possibly a simple change in design would remedy the condition, only to find that nothing has been done about it several months later. This is a simple example of the truth of the old adage that "an ounce of prevention is worth a pound of cure." A few dollars spent in the correction of an improperly designed part may prevent a failure on the road that results in many thousand dollars damage to equipment and roadway.

During the past five years the railroads have established many records and one of those records has been

a reduction in the unit cost of equipment maintenance. To set up a record sometimes has its disadvantages in that it demonstrates on one hand the fact that is was possible to do something which probably many thought couldn't be done and on the other hand the fact that having set up the record it is going to be somewhat more difficult to equal or beat it next time. And that is just the difficult position that the railroad shop finds itself in at the beginning of 1930. Next year's job has to be handled with a lot more serious thought than last year's if another is to be set up. The problem of improving maintenance methods is of sufficient importance and magnitude to remove part of it from the shoulders of the foreman and place it in the hands of a shop engineering department in which specially trained men can view the problem as a whole and study it in detail.

Equipment Conditions During 1929

SINCE 1923 great strides have been made in improving the effectiveness and economy of almost every phase of railway operation. It is one of the penalties of such records of improvement that a time ultimately comes when the continued breaking of past records becomes extremely difficult, although the demand for improvements continues.

In past years we have commented on numerous evidences of improving efficiency in the maintenance of cars and locomotives, such as the reduction in the number of employees, reductions in the percentage of cars and locomotives out of service for repairs, and in the number which had actually received repairs. Comparing the performance of 1929 with 1928, one is forced to the conclusion that the railroads have about reached the ultimate in improvements in these respects and that, barring major changes in conditions the upholding of the records already established will indicate a satisfactory performance.

In commenting on the achievements of the mechanical department a year ago, the following statement was made: "There are evidences that the tendencies which have predominated in the locomotive and freight-car market of the United States since 1923 have about run their course and that the turning point is now, or soon will, be at hand. In the case of locomotives, installations have been higher than orders continuously since 1923. During the first two years of this period a relatively large proportion of the locomotives installed were also retired from the books of the carriers. After being rebuilt, in the main with certain modernizing betterments, they were reinstalled in the books of the carriers. Since 1925, however, many more locomotives have been retired than have been installed, indicating that a large proportion of the locomotives retired were not considered suitable for rebuilding and that they have been scrapped."

The comment on the freight-car situation concluded as follows: "When it is recalled that during 1923 approximately 214,000 freight cars were retired, while 232,000 were installed, and that the number of cars installed has been declining steadily each year since, having dropped below the number retired in 1925 and now having dropped below the number of cars ordered, the evidence of the completion of the general rebuilding program introduced in 1923, would seem to be complete. As in the case of locomotives, the future need for restored serviceability will have to be supplied in a large measure with equipment built new from the ground up."

The turning point anticipated was reached during 1929, particularly with respect to freight cars. During the year orders were placed for 11,218 freight cars for use in the United States, which is the largest number of orders placed in any year since 1924 and which has only been exceeded during two years since the year, 1918.

A similar, though less marked, increase in locomotive orders is also recorded. The number ordered for use in the United States was 1,212 as compared with 603 in 1928 and 734 in 1927. This number, however, was exceeded every other year since 1922, with the exception of 1925 when the number ordered totaled 1,055, and it does not, therefore, represent as complete a turn in the market as is indicated in the case of freight cars. Conditions all point to a continuation during 1930 of the more liberal expenditures for new equipment of last year.

The condition of the equipment in service continued to be highly satisfactory in 1929. There was, in fact, a slight improvement in the percentage of equipment out of service for repairs, though this was less marked than the improvements of other years since 1923. According to Car Service Division reports for the first 10 months of 1929, the maximum per cent of cars out of service for repairs in any semi-monthly period was 6.5, and a minimum of 5.7 per cent was reached at the end of the period. In 1928 a maximum of 6.9 per cent of cars out of service for repairs was reported and more than 6.5 per cent were reported during twelve semi-monthly periods in the ten-month period. In the case of locomotives, the maximum percentage in or awaiting shop for all classes of repairs during 1928 was 15.5 and the minimum 13.4. In 1929 the maximum was 15.4 per cent and the minimum 12.4 per cent. For the entire period, however, the average margin in favor of the year 1929 was small.

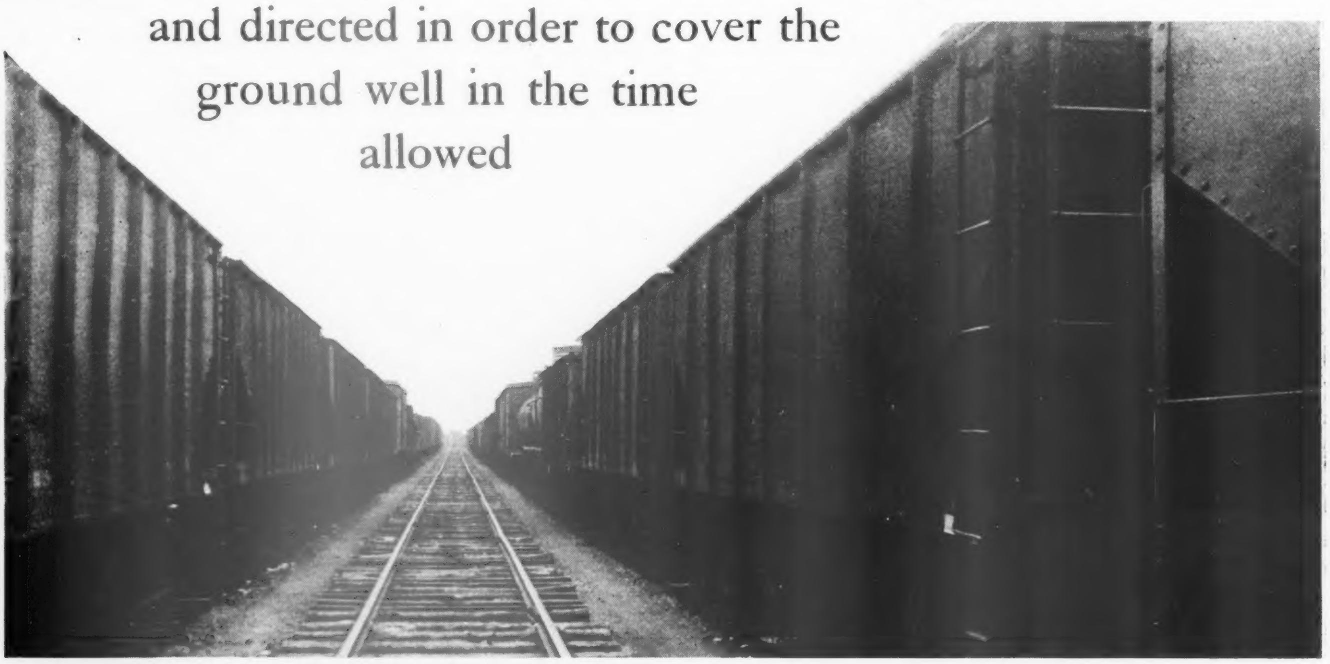
The changes in the number of men employed in the maintenance of cars and locomotives have been relatively slight during 1929 as compared with 1928. The September wage statistics report of the Interstate Commerce Commission shows slight increases in some and slight decreases in others of the important groups of maintenance-of-equipment employees, as compared with the number in service during 1928.

Operating efficiency has continued to improve, however, in every direction. The average freight-train speed increased from 12.8 miles per hour in 1928 to 13.1 miles per hour in 1929; the average net train load increased from 793 tons to 812 tons, and the gross ton-miles per train-hour increased from 23,571 to 24,628. There was also an improvement in fuel performance, both in passenger and freight service. The pounds of fuel per passenger-train car-mile decreased from 14.9 to 14.7, and the pounds of fuel per 1,000 gross ton-miles decreased from 125 to 123.

The new high standards to which both cars and locomotives are being maintained are reflected in greater reliability of the equipment in service and in the smaller amount of work, particularly in running and light repairs, required to maintain the new standards, now that they are thoroughly established, than was required in earlier years when the standards were less exacting than they have been since 1923.

Inspecting the Main Tracker for Long Runs

Inspection and repair forces must be well organized and directed in order to cover the ground well in the time allowed



VARIOUS systems of inspecting freight cars are in effect on railroads where the long run and "main tracker" service has been established. Their problems are identical to the end that trains may be despatched on schedule time, the equipment maintained in such condition as to prevent failures and duplicate inspection at intermediate terminals eliminated. It has been found unnecessary to maintain car-inspection and light-repair forces at each terminal through which trains are moved because, in the past, these were usually provided to detect defects that were passed up by inspectors at the initial or despatching terminal.

With the abolition of these forces at intermediate terminals the realization of the responsibilities was firmly established in the minds of all car-department employees at initial or despatching terminals and such rigid inspection had to be made at these points as to assure equipment being in safe and serviceable condition to reach its destination without further inspection or repair. In some cases surveys developed that inadequate forces were being maintained at initial terminals properly to inspect and repair cars for long runs. Therefore, a number of employees, whose services could be dispensed with at intermediate points, were given employment at main despatching points, thereby strengthening the organization at terminals where main trackers were classified and prepared. This made it possible to prepare trains in such a manner that they could be despatched on the regularly scheduled departure time.

Assuming that the inspection of trains is made on the inbound movement before switching or classification takes place, it is well to consider whether it is necessary to maintain forces in excess of those actually required to cover the inspection and light repairs to cars. Two inspectors, one on each side of the train, should be able to inspect a 100-car train properly in 1½ hours and two light repairmen, following the inspectors, should be able to make all light repairs such as applying brake shoes and keys, applying or opening cotter keys, etc., which have been marked up by the inspectors, in about the same time. Therefore, a terminal despatching 16 or less 100-car trains each 24 hours should require but two car inspectors and two light repairmen to handle the inspection and repairs on each eight-hour shift.

After a train has been classified and made up by transportation department employees, air-brake inspectors and repairmen, and the box packers and oilers should begin their work. The time allowed for the testing of air brakes and the treating of journal boxes by the transportation department will govern the number of these employees required to handle the work. Testing the air brakes and making necessary repairs to them should not require more than from 30 to 45 minutes on a 100-car train, with two air-brake inspectors, one working from the rear end and one from the head end of the train, each followed by one air-brake repairman. In order to treat the packing properly or to set up the packing when required or to apply additional oil or packing to the journal boxes on a 100-car train in 30 minutes will require the services of 12 box packers and oilers, six working on each side of the train and each working toward a given point.

As far as practicable the arrivals and departures of trains at a given terminal should be evenly distributed

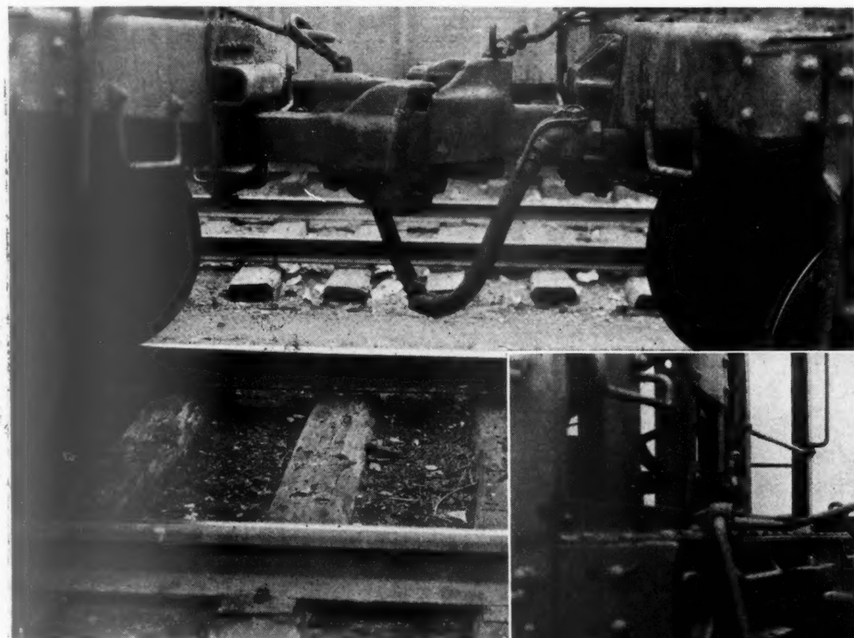
over an eight or 24-hour period in order that the car department can maintain an inspection and repair force consisting of a minimum number of men yet adequate to handle the maximum demands made upon it. Fixed despatching schedules will overcome the difficulties caused by a large number of arrivals or departures within a short period of time followed by a relatively small number of trains to handle over a period of several hours.

Therefore, in order to handle sixteen 100-car trains over a 24-hour period, an organization consisting of the following men is required: Two car inspectors, two light car repairmen, two air-brake inspectors, two air-brake repairmen and 12 box packers and oilers, or a total of 20 car department employees under the direction of a competent supervisor.

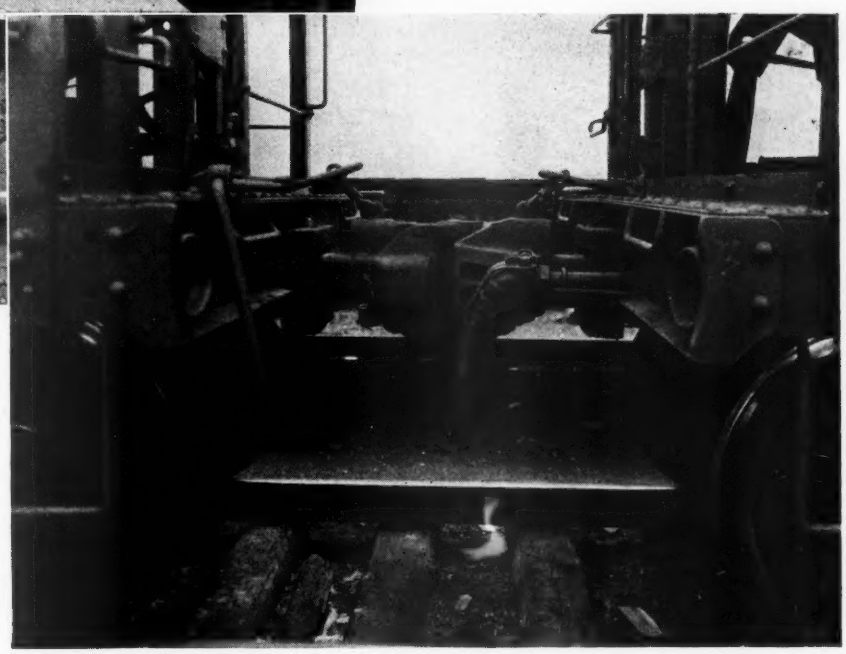
Inspection and Light Repairs

Upon arrival in the yards incoming trains should be stretched in order that such defects as slack in draft gears, causing air hose to raise or the uncoupling arrangement to become taut and raise the knuckle locks, can be detected. After the engine has been uncoupled from the train, blue flags by day and blue flags and blue lights by night, should be displayed at both ends of the track and the switches at both ends of the track should be locked with a private or standard lock designated for this purpose. The key should be retained by the inspectors or other parties responsible for their safety, protection to be maintained until all inspectors and repairmen complete their work.

Careful inspection of all parts of a car must be made to assure it being in good mechanical condition and that it has been loaded in accordance with the A. R. A. Loading Rules to prevent failures before reaching the final destination. Draft gears should be examined to see that no excessive slack exists; all cotter keys in draft keys and draft key retainers must be in place and properly opened. Couplers below the minimum or above the maximum heights should be adjusted or the cars placed on repair tracks for adequate attention. Sills, doors and safety appliances must also receive careful inspection. All journal-box lids should be raised and kept open until after the boxes have been treated by box packers. Journal bearings should be carefully examined to see that they are not excessively worn or that the babbitt lining has not turned. Journal boxes showing indications of having run hot previous to arrival in the yard should have the brasses removed and a careful inspection made of the journals to determine the cause and to prevent further trouble. Cars having air brakes overdue for periodical cleaning should be shopped out and placed on the light-repair track, where the triple valves should be changed and all work performed in accordance with A. R. A. Rule 60.



Below — Trains should be stretched upon arrival in yards.



Above—Couplers below the minimum or above the maximum heights should be adjusted.

Brake beams, including hangers, pins and cotters, must receive a close inspection and where found worn to the extent that they are liable to fail and cause delays, a car should be shopped. It is well known that brake heads having the bottom lug worn to $1\frac{1}{2}$ in. or less in thickness are liable to break off and allow the brake beam to drop on the rail, with the possibility of

causing a derailment of the car or a train delay.

Wheels having cracked plates or brackets due to previous heating from brake applications, or having seams in the throat of a flange or in the tread, are sometime difficult to detect. The defect may be located on the rail or behind the brake shoe. Every precaution should be taken to locate these defects as they render a car unsafe to remain in service. Other wheel defects such as flanges and treads worn below the A. R. A. limit gage, chipped or broken treads, and wheels loose on the axle are equally important. Careful inspection should be made to locate such defects and where found the car should be shopped.

Doors, door guides, locks and hasps on closed cars should be examined to see that they are in proper condition and that the doors are in place and not liable to swing out while the car is in transit. Where doors are bulged out, indicating that the lading is against the door due to the inside door protection having been omitted, the car should be placed on the repair track and the load adjusted. This is very important at interchange points, as the A. R. A. Rules make this defect a delivering line responsibility unless it is detected at the interchange. The door mechanism on open-top cars

Pistons with less than 7 in. or more than 9 in. travel should be adjusted to 8 in.

must be inspected to see that it is intact so that the doors can be properly closed and locked. When cars are under load they should not pass inspection unless they are properly closed.

Safety-appliance defects are a violation of the law and must be corrected to meet the requirements of the Federal safety-appliance laws and the A. R. A. Rules.

Light car repairmen following the car inspectors should apply missing box and column-bolt nuts, carrier-iron bolts and nuts where they are found to have been lost out, brake shoes and keys where necessary and any other defects found and marked by the car inspectors.

Where lading, such as lumber, pipe, plates, bars, machinery, castings, etc., is carried on open top cars, it must receive a careful inspection to ascertain whether it has been loaded and braced in accordance with the A. R. A. Loading Rules and that it has not shifted in transit. Loads carried on two or more cars must be examined to see that they are in good condition and that the cars have been equipped with proper spacing blocks between the coupler and striking casting to take up all draft-gear slack. Locomotive cranes and other pivoted machinery must have proper anchor rods applied and secured to prevent swinging, which might cause them to sideswipe passing trains.

Testing and Repairing of Air-Brake Equipment

After a train has been switched and classified by the transportation department and turned over to the air-

Terminal tests should be made from the yard supply line

brake inspectors and repairmen, the tracks must be properly flagged and switches locked before any work, including inspection, is performed. The angle cock on the rear car should be closed or a dummy coupling applied and air turned into the train line from the yard air line and the brake pipe charged to from 70- to 90-lb. pressure. Air brake inspectors and repairmen should then go over the train, correcting all air leaks which are audible and making any other repairs found necessary such as applying release rods, opening cut-out cock handles found closed, etc. Returning to the charging end of the train, they should then proceed to make a 25-lb. brake-pipe reduction from the train testing device, applying the brakes in service position. Going back over the train, the piston travel should be observed and all pistons found with travel less than seven inches or more than nine inches should be marked up so that repairmen can adjust them to eight inches. Pistons which fail to apply or have leaked off should be examined and corrected by making the necessary repairs or the car should be shopped out of the train and placed on the repair track where repairs must be made before it is returned to service.

If a sufficient force is not available to get over the train in 10 minutes to observe piston travel the brakes should be released and again applied in service. It is imperative that the air-brake equipment of all trains be in 100 per cent operative condition in order to meet the I. C. C. requirements and also to assure the safe handling of trains over the road. After making the terminal test with the yard supply line to observe that

all brakes have applied and released properly and that the brake-pipe leakage is not in excess of six pounds per minute, the road engine may be coupled to the train and the train despatched after making a road test with the engine to see that brakes have applied and released on the rear car.

Inspection and Care of Journal Boxes

Hot boxes and cut journals are responsible for more failures which necessitate setting off cars on the line than any other cause. Journal boxes, after being properly treated, should cause no trouble by running hot until the car reaches its destination, provided the journal is not scored and the bearing is in good serviceable condition. Of course, there are cases where the lining in the brass becomes loose because it has been improperly tinned or because there are hard spots in the lining, etc. However, the great majority of hot boxes are caused by insufficient lubrication of the journal bearing and waste grabs.

Box packers and oilers should be provided with metal buckets having partitions separating the good sponging from that which has been removed because of being dirty or excessively dry; a packing knife and hook; an oil can supplied with a good quality of car oil and a regular inspectors' lamp for use at night. They should be supplied with printed instructions governing the manner in which journal boxes should be treated and, to ascertain that they are thoroughly familiar with these instructions, periodical inspections of their equipment should be made and they should be required to demonstrate the manner in which they perform their work.

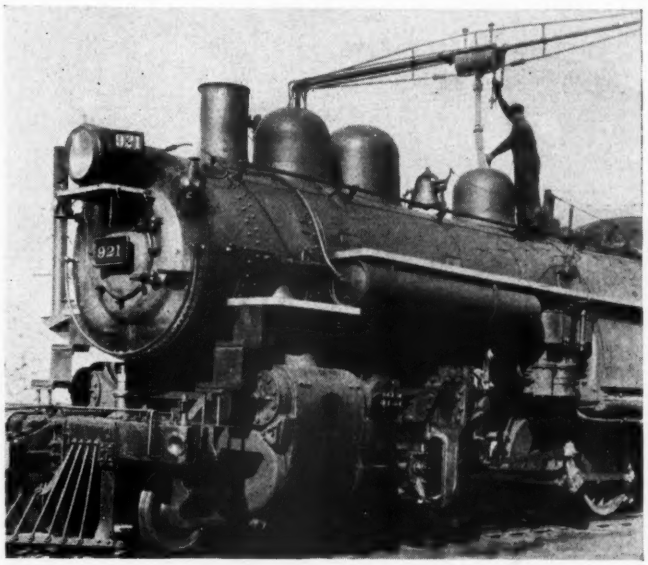
Where front pieces are in use, they should be removed from the journal box, shaken out and placed in the smaller compartment of the packing bucket. All packing should be firmly pushed toward the back of the journal box, being careful to see that it does not extend above the center line of the journal. Well lubricated sponging should be applied where necessary and if the sponging in a box appears to be dry a quantity of oil should be added. It is not recommended, however, that free oil be used in excess. The front piece which was removed from the box should now be replaced, making certain that no loose ends are hanging from the box. Boxes treated in this manner should not run hot and careful inspection and treating will be found an aid in reducing the number of cars set off on the line from these causes.

Inspection at Intervening Terminals

It may be desired to give trains a running inspection at intermediate terminals where coal and water are taken or crews are changed. In event this is thought advisable for the purpose of detecting shifted loads, parts dragging or any new defects which may have developed after leaving the initial terminal, there is no objection. They can, however, be entirely eliminated. This will result in establishing more rigid inspection by the inspectors at the initial despatching terminals and will prevent delays at intermediate terminals occasioned by holding trains for inspection and setting out cars which are safe to move to the final destination. In the majority of cases where cars are set out at these intermediate points it is because a local inspector holds a different opinion as to the seriousness of a defect which was passed by an inspector at the originating point, rather than because of defects which developed while the car was in service.

Air Sand Elevator with Gravity Delivery

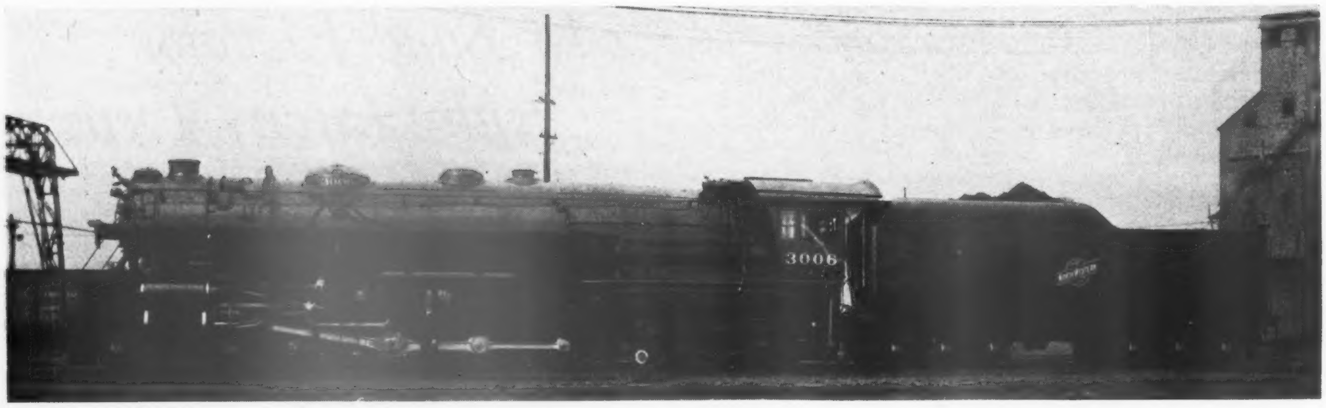
THE air-pressure, gravity-feed sanding-equipment used at the engine terminal of the Delaware & Hudson at Wilkes-Barre, Pa., has proven to be advantageous in many ways besides being a labor saving device. The apparatus consists of a 2-in. pipe line leading from the main sand drum in the sandhouse to a small cylindrical reservoir, located over the center of the tracks. The flow of sand from the source of supply to the small drum over the tracks, is controlled by valves at this drum and is more uniform than when the controls were located in the sandhouse. This is due to the fact that the sand flows to the small drum, hits an arrangement of baffle plates and then falls by gravity into the sand dome of the engine, the air pressure being exhausted through two exhaust ports on top of the drum, which are screened to prevent the blowing of sand over the locomotive. The two small operating valves located near the small drum permits the hostler to take sand without the assistance of another man in the sandhouse.



Sanding with the air-pressure gravity-feed device

In addition to the saving of labor there is the big advantage of the uniform gravity flow over the former method when the controls were located in the sandhouse, which caused the sand to be forced out in intermittent gushes, between which the air, blowing out of the sand nozzle, agitated the sand in the dome of the locomotive and created a cloud of dust which settled on the jacket and running boards. The flexible nozzle used in this device is equipped with two Barco joints which permits sand to be taken within 5 ft. on either side of the drum.

CLASS I RAILWAYS reported to the Interstate Commerce Commission a total of 1,747,816 employees as of the middle of September. The total compensation for September was $248,012,305. Compared with the returns for the corresponding month of last year, the summary for September shows an increase of 1.45 per cent in the number of employees. The total compensation shows an increase of 3.5 per cent.



New Chicago & North Western 4-8-4 type locomotive at Chicago terminal

Heavy 4-8-4 Locomotives for the North Western

Built by Baldwin, for passenger and freight service—Tractive force, 84,200 lb. with 76-in. drivers

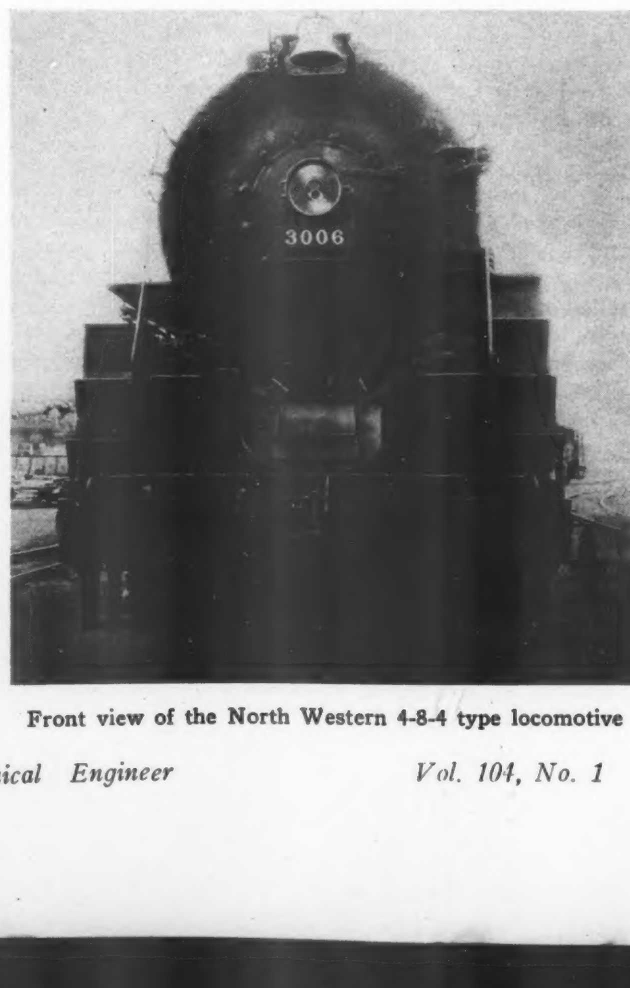
THE Chicago & North Western received during the latter part of 1929 35 steam locomotives of the 4-8-4 type, known as Class H on the road, and notable for their great weight and power, and for the application of many fuel-economy accessories. Designed by the North Western mechanical department, in collaboration with The Baldwin Locomotive Works, and built by Baldwin, this modern locomotive develops a tractive force, including the trailer booster, of 76,500 lb. at 250 lb., the boiler pressure at which the locomotives were working when received from the builder. The locomotive is designed, however, to carry 275 lb. with a factor of safety of 4.5 and, at this pressure, the maximum tractive force of 84,200 lb., including 12,400 lb. available with the trailer booster cut in. The locomotive in working order, with the loaded tender, weighs 818,000 lb.

The new locomotives are used in long-run service on the Corn King Limited and 16 other daily trains between Chicago and Omaha, Neb., and also on a number of fast-freight runs. The provision of this power avoids the necessity of double-heading heavy passenger trains in severe winter weather and permits handling these trains with much greater operating economy than formerly. With a large capacity tender, the only water stops between Omaha and Chicago, for example, are at division points such as Clinton and Boone, Ia., where regular stops are scheduled for other reasons.

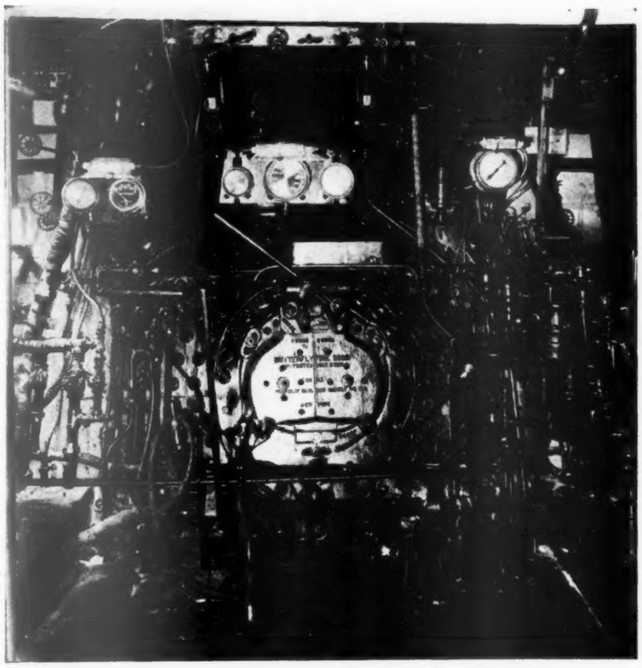
The Class H locomotive is designed to develop high sustained horsepower at speeds and to achieve unusually good results as to fuel performance. The locomotive is equipped with the Type E superheater, the American multiple throttle, and the Worthington Type S feedwater heater with the hot-water pump neatly located under the left front running board. It has three Thermic syphons, two in the firebox and one in the combustion chamber. A modified Type B stoker is applied.

Tender Trucks Equipped with Roller Bearings

Other features of interest include the provision of a Commonwealth one-piece cast-steel bed frame with integral cylinders, a one-piece cast steel water bottom tender frame, and complete Alemite lubrication to



Front view of the North Western 4-8-4 type locomotive



Interior view showing the carefully studied cab arrangement

all parts of the locomotive spring rigging, brake rigging, motion work, etc., except the main and valve crosshead guides and the rods. The former are lubricated from a Detroit 8-feed 16-pint force-feed lubricator, and the latter in the usual manner with grease plugs. Twenty-five of these locomotives are provided with tender trucks having the American Steel foundries roller-bearing unit and Shafer roller bearings. The trucks on all of the tenders are of the six-wheel type equipped with American clasp brakes, developed by the American Steel Foundries especially for use on locomotive tenders.

The boiler and machinery are designed for 275 lb. pressure. The boiler is of the conical design, the largest course being 100 in. outside diameter and $1\frac{3}{16}$ in. thick. A long firebox, with a total grate area of 100 sq. ft., is provided. With the combustion chamber, 5 ft. long, and the arch tubes and syphons, the combined firebox heating surface is 558 sq. ft. The ash pan is of cast steel construction, of the single-hopper type with air openings of not less than 180 per cent of the total tube area.

The main locomotive frame, including the cylinders, frame cross-ties, valve-gear and guide supports, the extension cradle over the trailer, and the brackets for feedwater pumps and train control equipment, is a one-piece steel casting, 58 ft. 3 in. long over all, which weighs 72,500 lb. It is the largest casting of this kind produced up to the time the Class H locomotives were built. The cradle portion of this frame is of the outside design, which permits the largest possible ash pan hopper capacity, and provides for the greatest slope of the sides of the ash pan wings.

Outside Steam Pipes Avoided

The cylinders are constructed with a high saddle, which is pocketed for the steam-pipe connections on the top of the saddle. This design eliminates the usual construction with the outside steam pipes passing through the smoke box, in openings which are difficult to maintain air-tight.

Power to drive the train control is taken from the right end of the front engine-truck axle. The air pump exhausts discharge from a separate channel cast integral with the smoke stack. The exhaust from the booster is passed by flexible piping to the tender tank, where it is discharged into the tank, or to the atmosphere, as desired. The engine truck is designed with outside journal bearings.

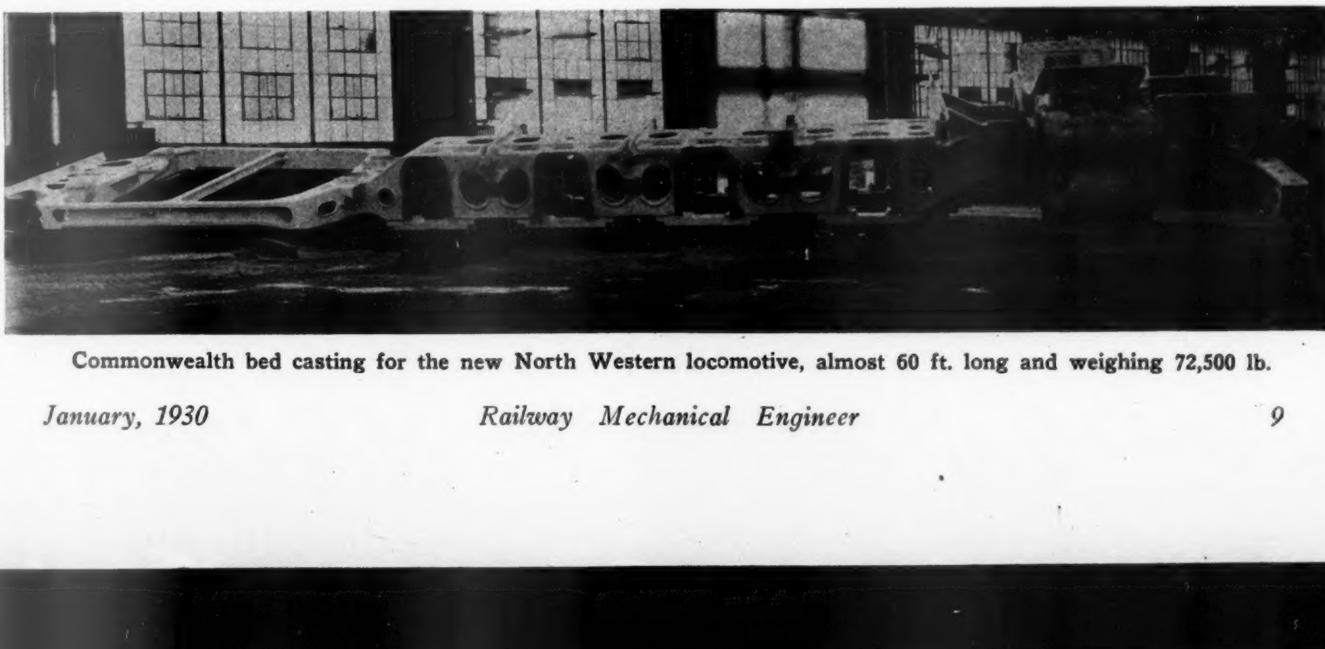
The main rods are of the tandem type, permitting the extension portion to form the side rod between the second and third pairs of wheels, which eliminates the usual knuckle-pin arrangement in the side rods. The crank pins are of annealed carbon steel, hollow bored and with holes plugged to permit grease lubrication. The design of the main crank pins is such that the one applied to the left side of the locomotive is $\frac{1}{8}$ in. oversize in diameter, thereby permitting the reapplication of floating rod bushings from the left to the right side after being worn to the limit.

Main and intermediate driving wheels are cross-counterbalanced. All driving boxes are of cast steel with full flanges inside and outside, with medium bronze side-motion plates securely fastened to the boxes. The main and intermediate driving-box brasses are of the three-piece adjustable type and all others are of the Markel removable type. All driving boxes are equipped with Franklin automatic adjustable wedges. The Alco lateral motion device is used on the front driving axle. Radial buffers with unit type drawbars are used between engine and tender.

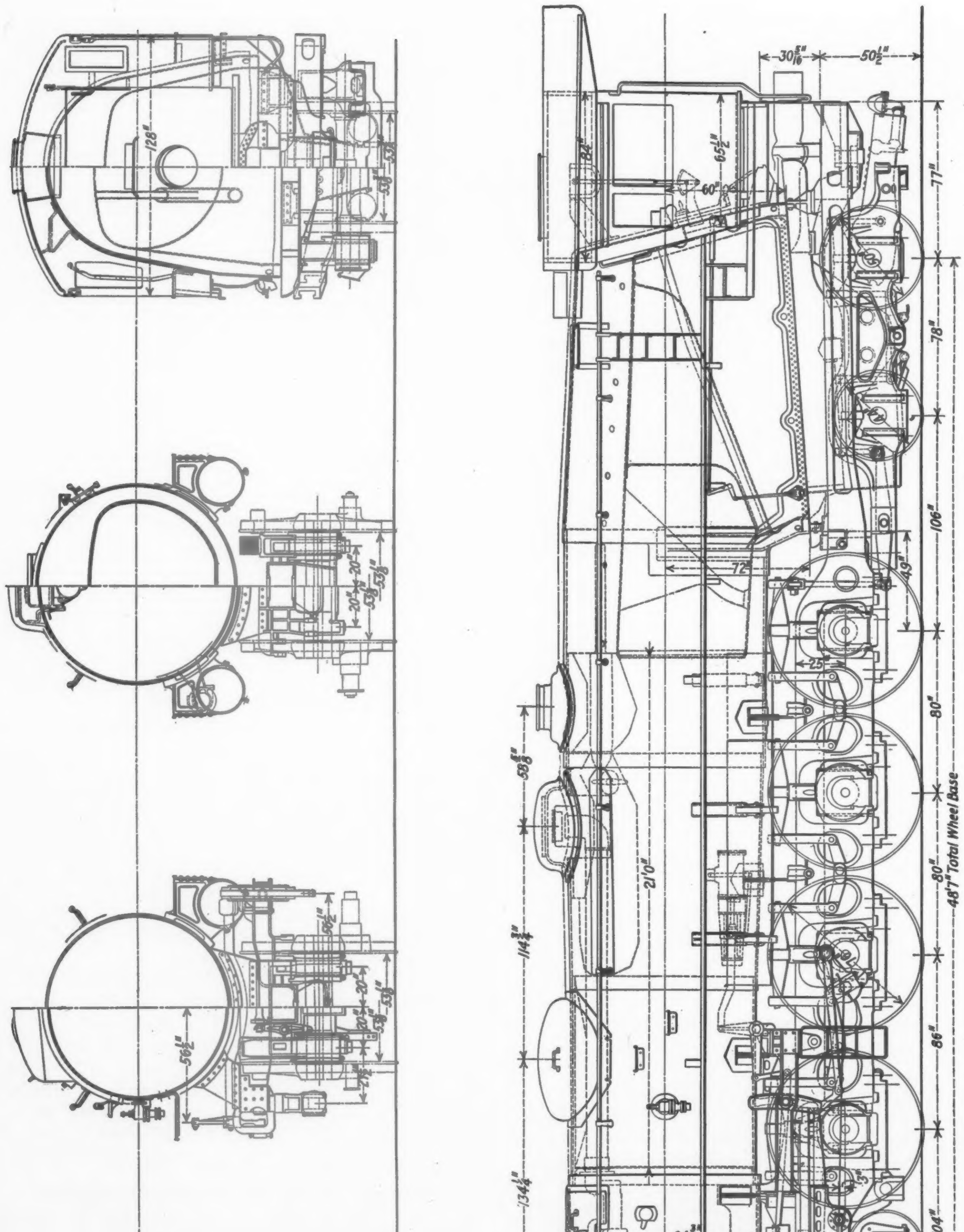
Detroit force-feed lubricators provide lubrication for the main cylinders and feedwater pump, a three-feed three-pint hydrostatic lubricator being used for the air pumps, stoker and booster. Alemite lubrication is used for driving-box shoe and wedge faces, wheel hubs of engine truck, driving wheels and trailer-truck wheels, and also for the throttle-lever connections, power reverse gear, bell, etc. Hoofer flange oilers provide lubrication for the front and back driving-wheel flanges.

Tangential Steam Separator Applied

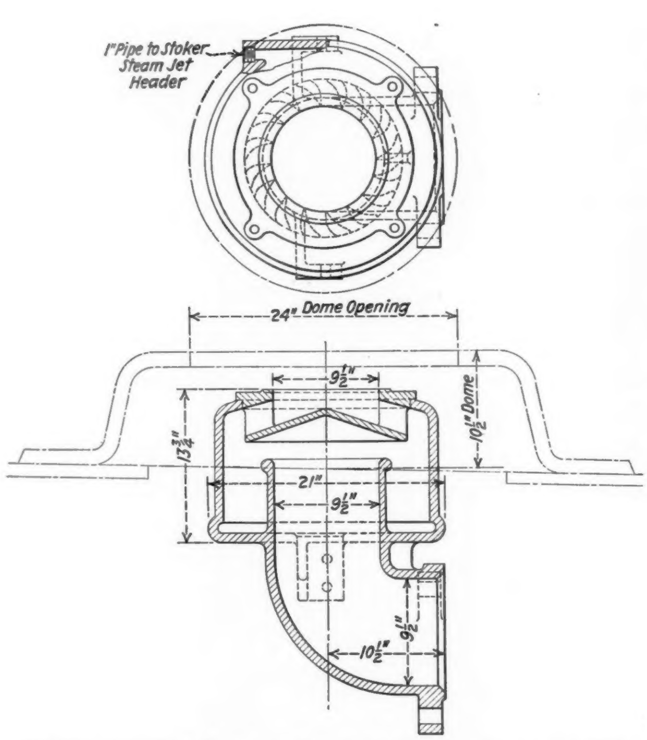
An Elesco tangential steam separator is located in the top of the steam dome and connected to the dry pipe



Commonwealth bed casting for the new North Western locomotive, almost 60 ft. long and weighing 72,500 lb.



Elevation and cross sections of the Chicago & North Western 4-8-4 locomotive



Elesco tangential steam dryer as applied to the North Western 4-8-4 locomotive

at that point. The water and wet steam from the steam separator is discharged by gravity through a 1-in. pipe and needle valve to the atmosphere. The Consolidated safety valves are located in the depressed top of the boiler-inspection manhole, which is located just back of the main steam dome. Superior flue blowers are used on each side of the combustion chamber to clean the combustion chamber and blow the soot from the tubes and flues. The locomotive is equipped with a Hancock long-bell chime whistle and Viloco pneumatic whistle operator. The whistle, located near the front end of the locomotive, takes its steam directly from the saturated-steam side of the superheater header. This location makes the whistle particularly effective as a warning signal and, at the same time, less objectionable to the crew.

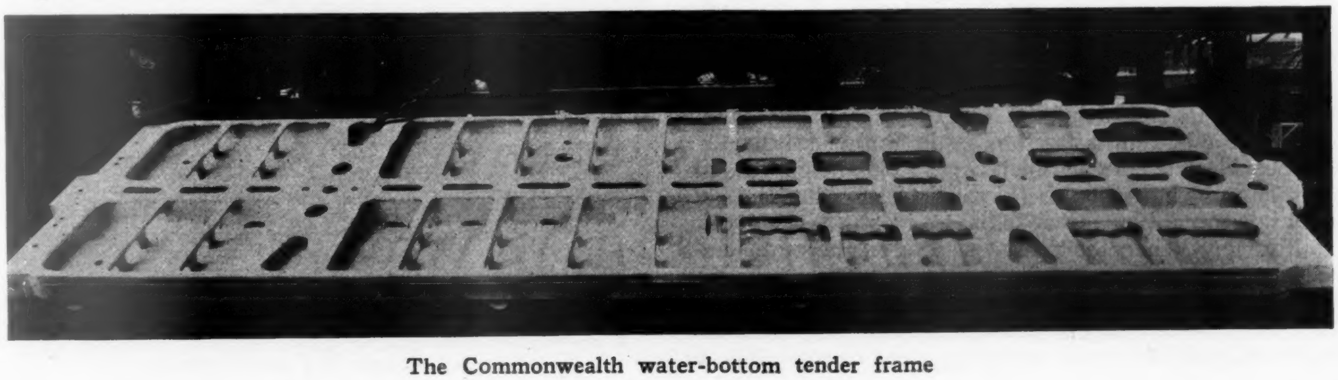
The large and roomy steel cab is wood lined, thoroughly braced and secured to the running board and boiler. It is furnished with suitable sliding windows and a double ventilator. Cab front doors are provided with Prime clear-vision windows, and Prime vertical-hinge storm windows are applied to the sides of the cab. The cab is also equipped with a foot warmer.

Among the other specialties included in the equipment of this locomotive, are the Golmar pneumatic bell ringer, T. Z. blower nozzle, Bird Archer blowoff cocks, Hunt-Spiller crosshead shoes, cylinder and valve bushings, Miner A-5XB friction draft gear on the rear of the tender, Barco flexible metallic connections, Hancock non-lifting injector, Johns-Manville cylinder and boiler lagging, Grip unit nuts on 30 locomotives, and McLean-Fogg unit lock nuts on five locomotives, Alco power reverse gear, Baker valve gears on five locomotives and Walschaert valve gears on 30 locomotives.

Principal Dimensions of the Chicago & North Western 4-8-4 Locomotive

Railroad	Chicago & North Western	
Builder	Baldwin Locomotive Works	
Service	Heavy pass. and freight	
Cylinders, diameter and stroke	27 in. by 32 in.	
Valve gear, type	5 Baker, 30 Walschaert	
Valves, piston type, size	14 in.	
Maximum travel	8 in.	
Outside lap	1⅝ in.	
Exhaust clearance	⅜ in.	
Lead	¼ in.	
Weights in working order:		
On drivers	288,000 lb.	
On front truck	87,000 lb.	
On trailing truck wheels	123,000 lb.	
Total engine	498,000 lb.	
Total tender	320,000 lb.	
Total engine and tender	818,000 lb.	
Wheel bases:		
Driving	20 ft. 6 in.	
Driving (rigid)	13 ft. 4 in.	
Total engine	48 ft. 7 in.	
Total engine and tender	91 ft. 1 in.	
Length over couplers	103 ft. 4 in.	
Wheels, diameter outside tires:		
Driving	76 in.	
Front truck	36 in.	
Trailing truck, back and front	50 in. and 44 in.	
Journals, diameter and length:		
Driving, main and intermediate	13½ in. by 14 in.	
Driving, others	12 in. by 14½ in.	
Engine truck	7½ in. by 14 in.	
Trailing truck	9 in. by 14 in.	
Boiler:		
Type	Conical	
Steam pressure (working)	250 lb.*	275 lb.†
Fuel, kind	Soft coal	
Diameter, largest course, outside	100 in.	
Firebox, length and width	150½ in. by 96¼ in.	
Combustion chamber, length	5 ft.	
Tubes, number and diameter	51—2 in.	
Flues, number and diameter	214—3½ in.	
Length over tube sheets	21 ft. 0 in.	
Grate area	100 sq. ft.	
Heating surfaces:		
Firebox	292 sq. ft.	
Combustion chamber	116 sq. ft.	
Arch tubes and syphons	150 sq. ft.	
Tubes and flues	4,656 sq. ft.	
Total evaporative	5,214 sq. ft.	
Superheating	2,357 sq. ft.	
Combined evap. and superheating	7,571 sq. ft.	
Tender:		
Style	Rectangular	
Water capacity	18,000 gal.	
Fuel capacity	20 tons	
Rated maximum tractive force	65,200 lb.*	71,800 lb.†
Rated tractive force of booster	11,300 lb.*	12,400 lb.†
Combined tractive force at starting	76,500 lb.*	84,200 lb.†
Weight proportions:		
Wt. on drivers ÷ total engine wt., per cent		57.8
Wt. on drivers ÷ tractive force	4.42*	4.01†
Wt. on rear trailer wheels ÷ tr. force	5.75*	5.24†
Total engine wt. ÷ comb. heat. surface		65.8
Boiler proportions:		
Tractive force ÷ comb. heat. surface	8.61*	9.48†
Tractive force × dia. drivers ÷ comb. heat. surface	655.0*	720.0†
Firebox heating surface ÷ grate area		5.58
Firebox heat. sur., per cent evap. heat. sur.		9.35
Combined heat. surface ÷ grate area		45.2

* As the locomotives were delivered to the railroad.
† At the maximum working pressure for which the boilers and machinery are designed.



The Commonwealth water-bottom tender frame

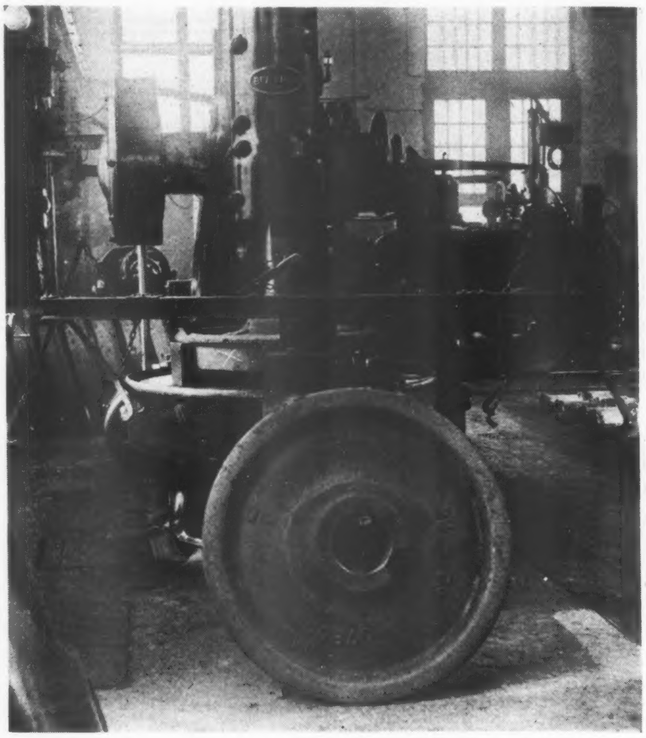
High-Speed Wheel Handler

AN efficient car-wheel handling device, developed at the Beech Grove, Ind., shops of the Big Four and used, among other places, at the Transcona shops of the Canadian National near Winnipeg, Man., is shown in the illustrations. It is used in place of the usual jib crane to load wheels into the car-wheel boring mill. It consists of two air cylinders located at the front of the machine and with their centers in line with the boring-bar center. Cylinder No. 1 is 3 ft. from the center of the boring-mill table and cylinder No. 2 is 3 ft. from No. 1. Attached to the top of the piston rod of cyl-

Car-wheel handler just after a new wheel has been placed on the boring mill

inder No. 1 is a bridge made of two I-beams, 6 ft. 6 in. long. This bridge revolves on a ball bearing. At each end of the cross bridge is an arrangement of four tongs, or fingers, for gripping the wheel flanges, all four tongs being releasable by the operation of a single lever. Attached to the top of piston rod cylinder No. 2 is a frame of two parallel bars spaced about 13 in. apart, which are hinged to a block mounted at the top of the piston rod. The ends of these bars adjoining cylinder No. 1 are supported by links which have hinged attachments to the floor at the bottom, as well as at the top where they are connected with the parallel bars. The height of the link is such that when the piston is raised the bars rest in a horizontal position at the same height as the boring mill table. When the piston is lowered the outer ends of the bars are dropped to the floor, the bars assuming a position slightly tilted from the vertical. The car wheel with the flange outward may now be rolled into position, with the tread resting on flanges projecting out from the lower ends of the bars and tilted against them.

When the piston is raised the wheel is raised to a horizontal position and directly in line with the tongs on one end of the cross bridge of cylinder No. 1. Therefore, the tongs on the other end of the bridge are directly over the car wheel on the boring-mill table. When air pressure is applied to cylinder No. 1, the tongs automatically grip the flanges of the wheels and

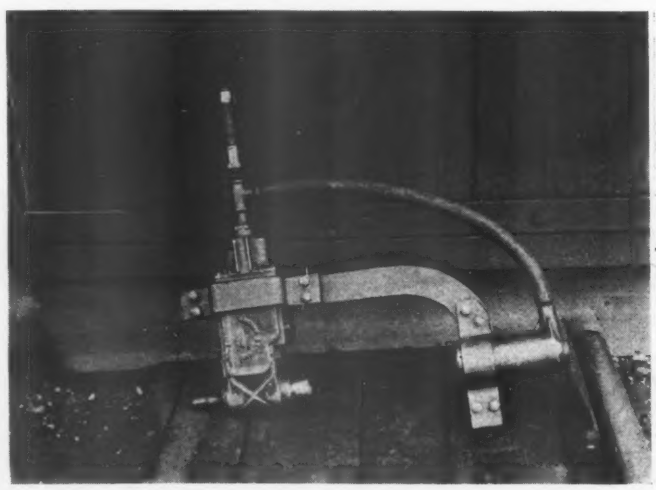


View showing a finished wheel lowered to the floor

raise them clear of the tables. The bridge is then revolved by hand and, when the air is released on cylinder No. 1, the wheel to be bored is placed on the boring-mill table and the finished wheel on the table of cylinder No. 2. This table remains in a horizontal position until the air is released, when it is lowered automatically to a vertical position, convenient for removal.

The illustrations show the device as applied to a Bertram high-speed car-wheel boring mill.

* * *



A convenient close-quarter motor support fed by an air-operated plunger in a small cylinder

Employees of the Atlantic Coast Line Locomotive Shops, Tampa, Fla.

How the Atlantic Coast Line Repairs Locomotives

Efficient methods of shop management effect economies in making repairs

By W. L. McGowan

Shop Engineer, Atlantic Coast Line Shops, Tampa, Fla.

Part II

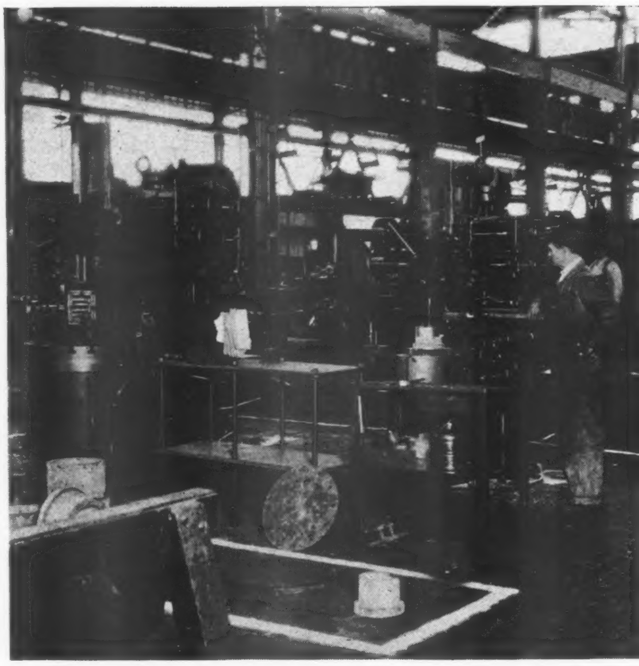
EACH month the shop superintendent of the Atlantic Coast Line shops, Tampa, Fla., receives a report which is shown in one of the illustrations, from the superintendent of motive power, showing 90 days in advance the status of locomotives on the division as to mileage and possible repairs needed. This report is forwarded to the general foreman with the shop superintendent's recommendations as to special or extra materials that may be needed, and such selections of power as he may make for future shopping. The storekeeper is also furnished with copies of these reports, and such other information as may be required to expedite the ordering of materials.

Locomotives are ordered out of service on the dates set by the shop. The superintendent of motive power receives a work report showing the nature and class of repairs required. He approves all or part of the work, and issues an order in sufficient time to precede the locomotive to the shop, and to afford ample time for the assembly of materials.

Locomotives are placed on the waiting track on arrival at the shop, and are shown on Form 344 as awaiting repairs until work is started. After that they are shown on the form as "under repairs," and "turned out" when the repair work is completed.

Each Friday morning the general foreman meets with the department heads, who discuss the work going through the shop. The production schedule for the following week is agreed on, and the distribution report for the shop is made out. Form 344 is used for this report. Any rearranging of dates on locomotives that may have gotten behind schedule is done at this conference. The material situation is discussed, and the general foreman thus obtains data for his weekly progress report to the shop superintendent.

Locomotives coming into the shop for repairs are placed on Tracks 1 or 2 and over pits *a* or *b* for stripping, according to the repairs needed. After stripping they are pulled into the shop by a fixed pulley arrangement which is attached to the hook of the 100-ton crane. They are then lifted by the two 100-ton cranes, and placed in a designated parking space. Large locomotives are placed on Track 1 and small power on Track 2. The wheels and appurtenances are then removed and



Typical table and bench equipment provided for each machine operator—Work orders are placed on the hook as shown on the table at the left—Material parking space is shown marked off in the foreground

routed to the cleaning vats where they are cleaned and routed to the proper groups.

Form 457, shown in one of the illustrations, shows a departmental working order. This order is made out in duplicate by the supervisor desiring the work done. He describes the nature of the work, enters the time the order was issued and time the work is required, and sends the form to the department concerned for the signature of the supervisor in charge. The latter writes the time the work will be finished on the form, and retains the original copy for his own file, returning the carbon copy. This system of work orders facilitates tracing delays.

Should the work as described on the work order be of such a nature as may cause delay to the locomotive production schedule, or should the time limit allowed be insufficient for that particular job, a delay report, Form 864, is made out in triplicate, copies of which are sent to the general foreman and to the shop superintendent. On receipt of this report the general foreman makes an investigation and reports the results to the shop superintendent. If the general foreman's report is not satisfactory the shop superintendent calls a meeting of all concerned at which the difficulty is discussed and a decision reached. This procedure not only settles the immediate question, but also establishes a policy for future guidance. Such meetings occurred frequently when the shop first started operation but are now required only occasionally.

Requisitioning and Delivery of Materials

Form 407 is a shop requisition for material which is made out to the storekeeper and must be signed by an authorized person. These forms are made out and dropped in small boxes, which are located in each department and at places convenient to material platforms.

A stores-department material messenger calls at each box on a 15-min. schedule, and delivers the requisitions to the receiving window in the store house. In case the material is not in stock, the counter man notifies the assistant storekeeper by telephone, who gives him a date when the material is expected, if on order. If it is not on order, he immediately places an order for it. The counter man writes this information on the back of the order, and returns it by the same messenger to the ordering department. Thus a record is created. Should the required material be expected at too late a date to meet the schedule, the ordering foreman reports the delay against the storekeeper.

Immediate delivery may be had by calling the assistant storekeeper who dispatches a messenger or one of the counter boys with the desired materials to the ordering department. In the meantime the foreman making the order, makes out the usual requisition and places it in the box, which is picked up by the boy who makes the delivery. Mass delivery is made by Ford and Chevrolet trucks and by Fordson tractor and trailer service.

Materials to be shipped are placed in a space reserved for that purpose in the shop near the shipping platforms. A box, which is much like a rural mail box, is provided at this space, for the purpose of receiving the usual shipping orders. This space is visited by the shipping clerk at frequent intervals, or when notified to do so. Three copies of the shipping form are usually made out. One is sent to the general foreman, one to the shop superintendent, and the other is placed in the box.

Special materials and materials or devices for stock are made by authority of a shop order, Form 3213-A. This order is placed on the storekeeper, who assigns a number, and authorizes the use of the materials necessary. It is then sent to the shop superintendent, who authorizes the labor, and forwards it to the general foreman, who files one copy for record and makes proper distribution of the charges. The foreman makes all charges for material or labor against the shop order number. The hours of labor together with the workman's shop number are entered on the shop order form opposite the date the work is completed. When all work is finished the order is returned through the same channels as delivered. When work is to be shipped to an outside point, the usual shipping order accompanies the work order on its return, a copy of which is placed in the box at the delivery parking space.

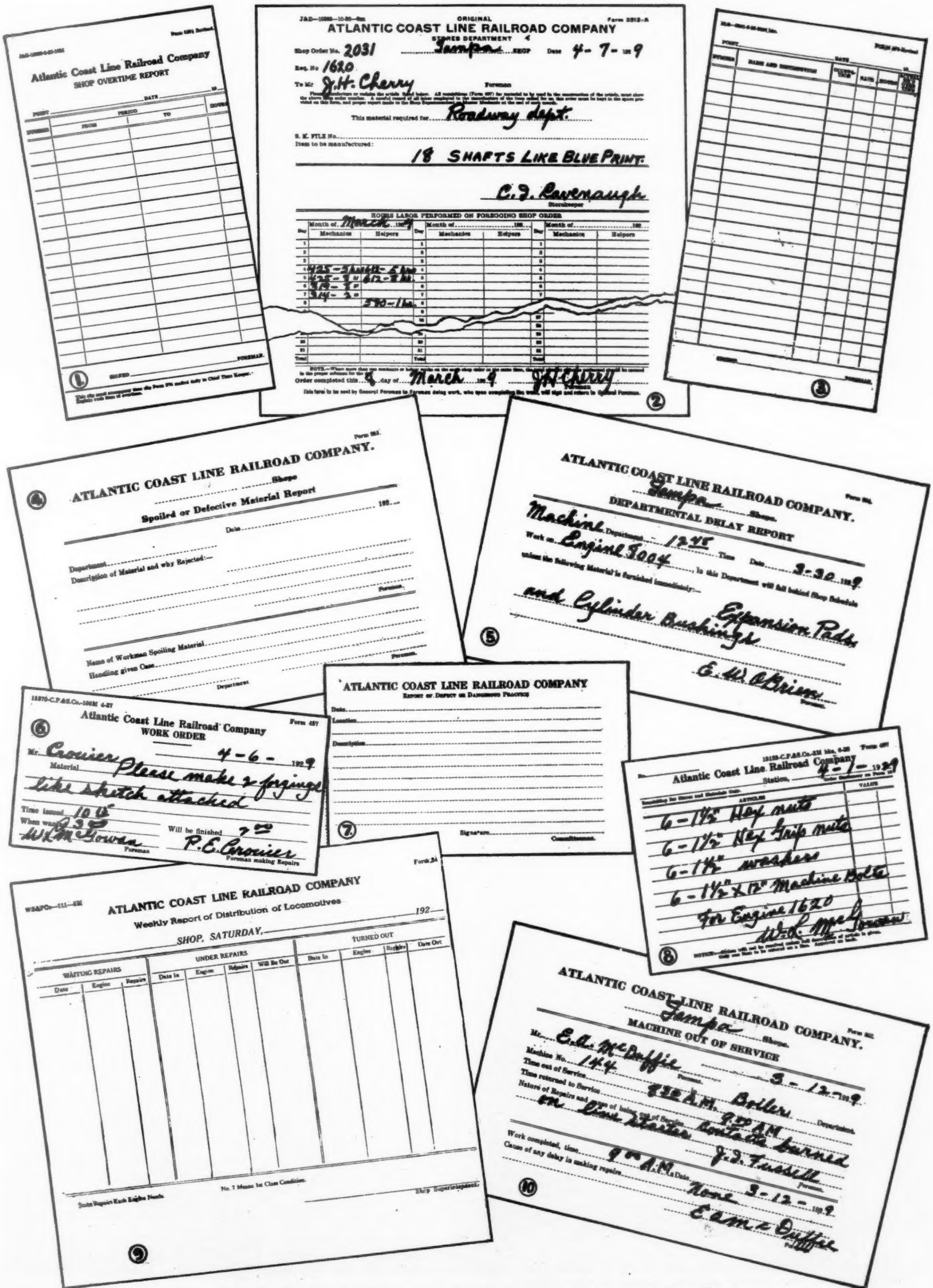
Making Repairs to Shop Equipment and Machine Tools

Two full-time men, a machinist and electrician, are assigned to "trouble shooting" in and about the plant. The electrician is on the floor at all times, while the machinist handles the larger part of his work in the manufacturing tool room.

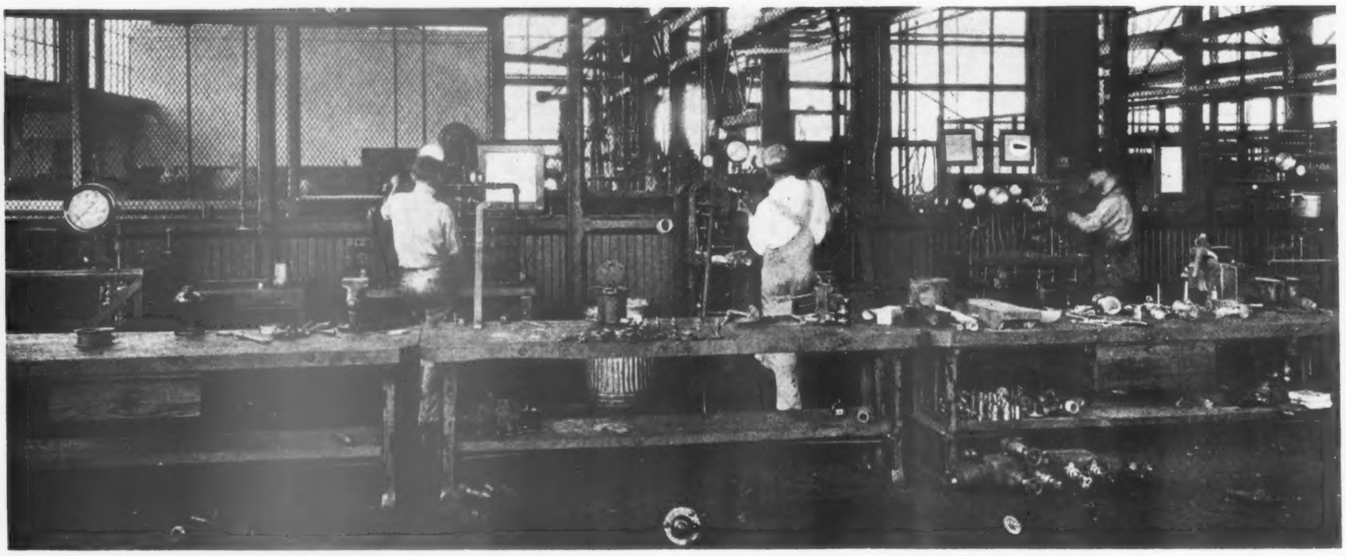
When a machine failure occurs, a machine out-of-order form, 862, is filled out and sent to the tool foreman. If the trouble is in the electrical equipment, the out-of-order form is placed on a hook which is fastened to a snap switch in group C. Placing the order on the hook turns the

Standard forms used at the Tampa shops, shown on the opposite page

Fig. 1—Form 432½, shop overtime report; Fig. 2—Form 3213-A, shop order; Fig. 3—Form 274, labor distribution report; Fig. 4—Form 863, defective material report; Fig. 5—Form 864, department delay report; Fig. 6—Form 457, work order; Fig. 7—Report to safety committee; Fig. 8—Form 407, Requisition for stores and materials; Fig. 9—Form 344, weekly report of distribution of locomotives; Fig. 10—Form 862, machine tool or equipment report of break-down.



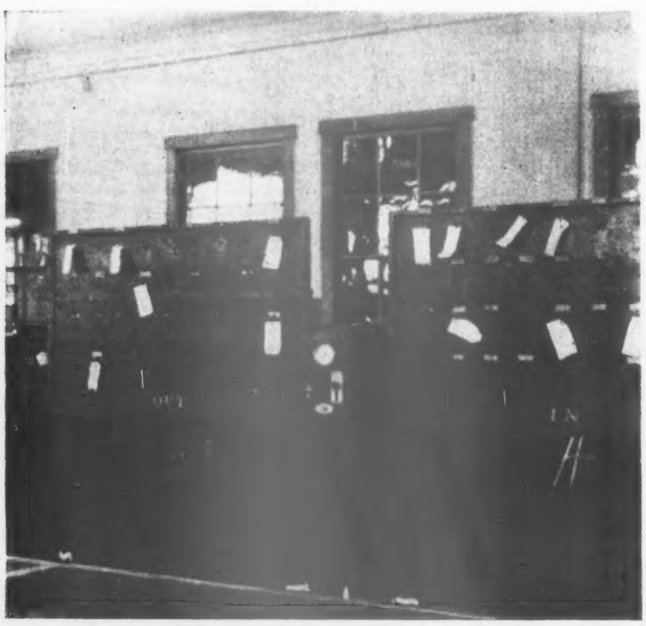
Standard forms used at the Tampa shops of the Atlantic Coast Line



The air-brake repair department

switch which lights a red flashing light. This light can be seen from practically any point in the shop. On observing the light, the electrician goes directly to this point and receives formal instructions. Thus the out-of-order time is reduced to a minimum, and the machine operator does not have to leave his machine.

Small double-deck square tables, 30 in. high, shown in several of the illustrations, are placed along the longitudinal aisle which extends through the shop. Two small metal boxes are located at the rear corners of the top shelf. One box is labeled "tool orders" and the other is marked "material orders." Also attached to the top shelf is a book of blank safety report forms, one of which is illustrated. A work-order book is placed on a line with the safety report book and immediately opposite. One of the blank work order forms (Form 457) is also shown. The workman makes out his own work order, when it is necessary to have tools hardened or dressed, forged or otherwise worked by the tool dresser.



The work-order boards—Orders for work coming into the machine shop are placed on the board at the right—Orders for work going out, on the board at the left

He describes the work to be done, writes his machine number on the face of the order, and places it in the box marked "tool orders." The worn tools are placed on the shelf of the table, and accompany the order. A machine shop messenger collects the tools and orders from these tables at frequent intervals, and delivers them to the tool dresser. As a rule, replacements, ground and ready for service, are available immediately.

Form 863, the spoiled and defective material report, is made out by a department foreman who considers it advisable to reject any part or parts. A copy of this form is sent to the general foreman, who takes such action as he deems necessary. This report is also used for broken or defective tools, and is made out by the tool-room attendant who obtains the workman's signature before returning his tool checks. In this case the copy is sent to the tool foreman who, if necessary, investigates the matter and finally reports to the general foreman.

A Time-Saving Procedure

Two large work-order boards, 5 ft. long by 3 ft. wide, shown in an illustration, and equipped with a number of hooks, are located in the center of the machine shop. Above each hook is a small clip under which a card marker bearing an engine number may be inserted. These boards are duplicates; that is, the same numbers appear on each board in the same location. A Strombeck time clock is located between the two boards. Ample space is marked out at the base of each board for the accommodation of materials. One board is marked "out" and the other "in."

When small jobs are brought from the erecting shop to the machine shop for machining, the part is placed on the floor at the base of the incoming board. The accompanying work order is stamped in the clock, which prints the time and date. The order is then placed on the hook bearing the engine number to which it belongs. The assistant machine shop foreman removes the order and enters thereon the number of the machine to which he assigns the work. He then places the order on a hook at the machine, and has the part placed by a laborer in the material space adjacent to the machine. The assistant foreman removes the orders from the "finished hooks" on the machine, inspects the finished work, and returns the work order to the out-going board, after stamping the time and date on the order

form. He then has the part removed to the space at the base of the order board, marked "out." When placing new orders on the incoming board, the erecting gang foreman usually look over such work as may be in the finished material parking space, and sends for it when required. Occasionallv an order is placed on the hook and the work remains at the machine for some time afterwards, because no laborers are available to bring the parts to the board. If the erecting shop men come to the board and find only the order, the machine number on the form shows where the part may be found. Thus, considerable time, frequently wasted in the transfer of work from the machine shop to the erecting shop, and vice versa, is saved.

Another advantage is that the time received and time finished appearing on the face of the order, eliminates one possibility of dispute on account of delays to the schedule. All orders are handled across the work-order boards except the following: driving boxes, wheels, crank pins, shoes and wedges, link motion, pistons and crossheads, and special rush orders or others needing special explanations. These are usually handled directly with the machine-shop foreman or his assistant.

The erecting shop forces are divided into gangs, and the gangs into specialized groups in much the same manner as the machine shop forces. Two gangs are under the supervision of one gang foreman. The gang foremen are directly responsible to the erecting shop foreman. The erecting shop specialized groups are organized as follows:

a—Steam pipes, dry pipes, superheater units, headers, damper brackets, petticoat pipes, and throttles.
b—Boiler mounting, whistles and bell rigging, marker brackets, and hand rail columns.
c—Spring and brake rigging.
d—Pistons, crossheads, guides, cylinder heads, valve crossheads, valve heads, piston-rod and valve-stem packing, cylinder cocks and rigging, and valves.

Piston valves are fully erected in the machine shop, ready to apply. The rest of the gang is made up of general floor workers. There are other special groups who work both gangs and are directly responsible to the erecting shop foreman. They are as follows:

e—The stripping gang strips, cleans and delivers all work.
f—The wheeling and unwheeling gang, which also cleans and applies side rods, brings material into the shop, and keeps all parking spaces in order.

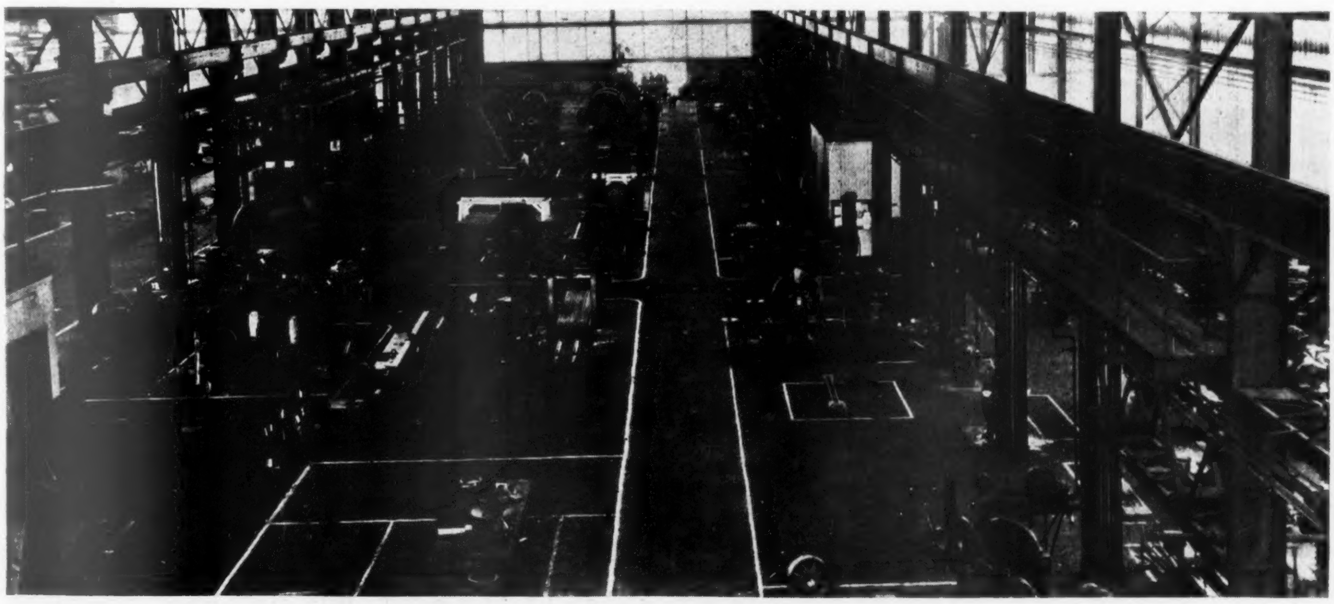
The shop schedule board

g—Tire group removes and applies all tires.
h—Squaring up. One mechanic and two helpers for every 20 engines.
j—Valves and valve setting. Applying valve gear, reverse levers, and setting crank arms.
k—Cylinder boring, valve boring, and facing of both, facing valve seats and cylinder-head seats.
l—Fitting driving boxes, applying lubricators, and turning crank pins.
m—Truck job. Trailer and engine trucks.
n—Outside repair work.
o—There is also one portable lathe operator in each gang for fitting bolts, etc.

These jobs are the responsibility of the erecting shop foreman as to placement, but are supervised by the gang foreman to whom they are assigned.

The boiler shop, tin and pipe shops are organized much the same as in most other railroad locomotive repair shops in this country.

The air brake department handles the air work for both the car yard and engine house, as well as the air-brake work for the entire third division. This department repairs and inspects all air-brake equipment, lubricators, cab cocks and fittings, whistles and pops, blow-off cocks, injectors and inspirators, gages, brackets and fixtures, bell ringers, fire doors, superheater dampers and air operated reverse gears.

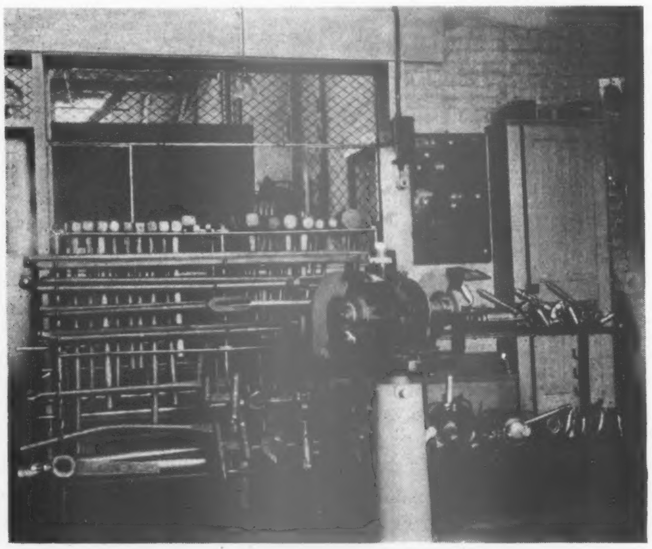


Interior view of the Atlantic Coast Line shops, Tampa, Fla.

A Convenient Rack for the Tool Room

IN any shop proper care of small tools is impossible without a clean and orderly tool room, with "a place for everything and everything in its place." The smaller the tool room the less foot work required of the man in charge, and yet there must be room for the storage of all tools required for the work at hand. The use of a rack such as is shown in the illustration makes the storage of a large number of small tools a simple matter.

The eight upright posts are made of ⅞-in. steel rods. The shelves are made of ¼-in. steel plate with holes cut in each corner so that they will fit over the uprights. First a section of pipe is placed over each rod and then a shelf put in place, then another set of pipes and another shelf, and so on. The pipe sections space and support the shelves. Cross braces made of ¼-in. by 2-in. steel bars are placed on top of each pipe section. Two extra bars of this material are placed lengthwise about 2 in. from the side braces, at the top of the rack, forming a slot the length of the rack. Handled tools are hung in this slot. Because of the handles only one shelf is made to the main part of the rack. Numerous hooks, of ½-in. steel, and turned up about 3 in. from the posts, are welded to the outer side of the pipes for horizontal placing of tools. The lower section of the rack, shown at the right, has two shelves for the storage of air motors. The rack may be quickly dismantled, or additional shelves can be added using rods of greater length.



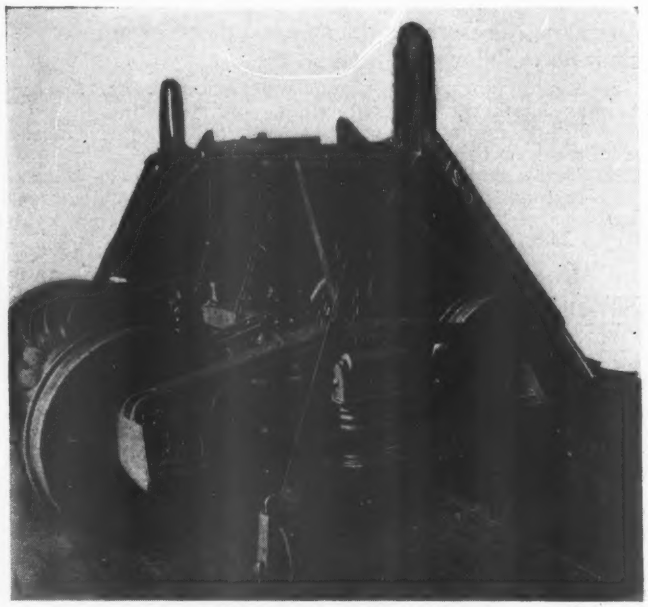
Compact rack for the storage of small tools

Near the bottom of the rack, at the left, are shown two specially built rivet buckers, for use in close places, such as under the body of freight cars. A 30-in. rod is used for a lever. Two 8 in. sections of 1½-in. round steel are slotted down half way at one end so as to fit over the lever. They are pivoted about 4 in. apart by loose rivets through the lever and held parallel by rivets through a short flat bar below and parallel to the lever. The long ends of the round bars project in opposite directions. One end is pointed and the other end is cupped. The latter is used on the rivet head while the pointed end acts as a pressure fulcrum.

Working Car Trucks

By Jos. C. Coyle

A LIFTING device, developed at the Denver shops of the Colorado & Southern, is designed to facilitate truck work and to eliminate minor accidents that are sometimes sustained in this type of labor. It consists of a frame mounted on wheels, the top of which is made of two 10-ft. sections of angleiron bolted together with the edges about 1 in. apart. The legs are of 3-in. angle section, well bolted and braced. The truck bolsters are lifted with chains that are suspended from the ends of 5-ft. levers, made from ¾-in. by 2-in. steel, that are bent upward a few inches from the end and supported by a pin through two 2-in. metal rollers. A 2-in. opening in the angles forming the top of the frame permits the supporting chains and the suspended load to move 18 in., the length of the opening, while work on the truck is being completed. When the load is raised in position the levers are held down by pins inserted in a 3-in. angle that projects 18 in. above the frame at each end. These are bent into the shape of an inverted U, drilled with a number of holes for the cotter pin, and bolted to the frame.



A truck hoisted into position by the lifting device

A heavy channel-shaped forging, 3 ft. long, is bolted to the middle of the frame and supports a stationary chain which is looped about the bolster in its hoisted position for the sake of additional safety.

An improvement yet to be made, which was overlooked in the original plan, is the use of swivel joints in the legs which will permit the frame to roll readily in any direction when not in use. When in use a set screw or cotter pin will hold the wheels rigid. Two men can quickly raise a truck bolster with this device and secure it with the pins after which the middle chain is hooked in place.

Shopping Freight Cars on a Life Expectancy Basis

The Nickel Plate adopts a policy of scheduling freight cars through the shops on a basis of pre-determined service life

For years it has been the practice on many railroads to shop locomotives on a mileage basis. Passenger cars are usually shopped on a basis of a certain number of months between shopping periods. Freight cars, however, were considered subject to service of such a character as to make a definite shopping assignment impracticable, except possibly for cars of all-steel construction. This was probably more or less true in the days of all-wood construction, but as steel has become more extensively used in car construction the determination of a service life for cars receiving ordinary usage has become more and more a possibility.

With this thought in mind a study was made by the New York, Chicago & St. Louis several years ago to determine just what would constitute a consistent shopping period for the various classes of freight equipment.

A series of composite 40-ton box cars, built in 1916 and 10 years old at that time, and a series of composite hopper cars, built about two years later, were used as examples for study and it was found that, with the exception of accidental damage, the hopper cars were in fair shape and had been in service for their entire life since being built without having received general repairs. The box cars, however, had commenced to appear on the repair tracks in such numbers as to indicate that this series was going to require extensive overhauling. Other types of cars, some being wood superstructure box cars with reinforced steel underframes, and others modern stock, hopper and automobile box cars, were made the subjects of investigation, and it was finally determined that a definite shopping period for repairs could be set up. This period would have to be determined by the natural life of the wood and metal parts used in construction and the ordinary wear and tear of service to which the car was assigned which might reduce the natural life of the material used.

With the information at hand a program for specialized general and intermediate repairs to various types of freight cars was adopted about May 1, 1928. This program was designed to provide for such repairs as

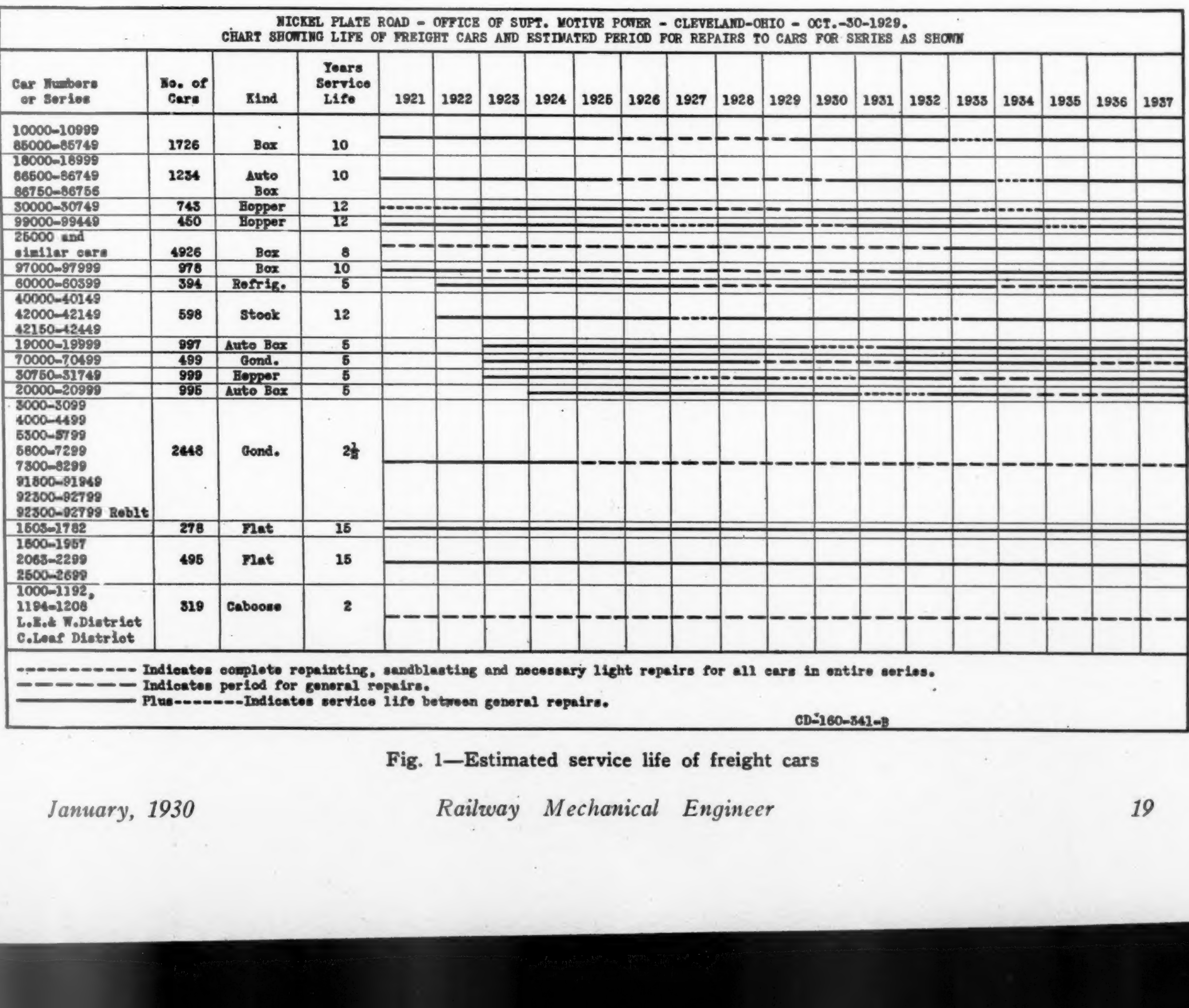


Fig. 1—Estimated service life of freight cars

would be necessary to maintain cars to suit the service for which the cars were required. It also provided a very definite expectancy of life for the various types of cars. It had been the practice, to some extent, to make repairs to the various classes of freight equipment without a definite view so far as the further life of the car was concerned. There were the usual restrictions on

MD-M 165

Shop ______
Date ______
Hrs. Per Car ______

Repairs made to this Car are such as will RESULT IN THE MAXIMUM SERVICE LIFE as shown on Life Chart Dwg. #CD-160-341-B for a car of this class receiving general repairs.

Trucks ______
Roof (Rem) ______ (App) ______

Body
Side plates No. ren. or spliced ______
End plates No. renewed ______
Side Sills No. ren. or spliced ______
Inter & Cen." " " " ______
End Sills No. renewed ______
Posts and Braces No. renewed ______

Car No. ______ Kind ______
Dft. Gear ______
Kind of Paint (Maker) ______
Kind of Thinner (Maker) ______
Formula:
1st Coat ______ Parts Paste
______ Parts Thinner
2nd & 3rd Coats
______ Parts Paste
______ Parts Thinner
Weather ______
Temperature ______
Floor No. ft. renewed ______
Lining No. " " ______
Sheathing" " " ______
Steel end repr. made ______
Steel underframe reprs. made ______

______
Foreman

Fig. 2—Form used for maintaining a historical record of individual cars

repairs to certain types of cars, of course, so that older equipment would not be repaired when retirement was in order.

With the idea of establishing shopping schedules on a definite basis a service life chart was worked up. This chart is illustrated in Fig. 1 and is self explanatory.

A Specialized Repair Force Established

In connection with the scheduling of cars as shown on this service life chart it became necessary to establish a permanent force of car repairmen who were assigned to specialized general or intermediate repairs at the various shops. Several of the repair points having facilities available for making general repairs to freight cars were assigned certain series of cars to repair. The assignments of cars to these shops were based primarily on the demand for certain types of equipment in their respective territories so that a long haul of bad order equipment could be avoided. The assignment of repairmen cannot be changed nor can the men assigned to specialized repairs be used on any other class of work except by the permission of the master car builder. Various checks, described later, have been devised to determine that the assignment remains intact.

The assignment of certain types of equipment to certain shops tends to reduce material inventories in that it is unnecessary to carry duplicate material items at several shops. Material items peculiar to cars being repaired at an individual shop are carried at that point and distributed by the stores department to other points requiring such material for running repairs.

The specialized repair program is revised monthly with a copy to all interested parties. The table shows this shopping schedule. It will be noted that the assignment of cars to the various shops is made several years in advance. The number of cars repaired each month is deducted from the total number which remained to be repaired on the first day of the preceding month, and

ADDITIONS AND BETTERMENTS were applied to this car at this period of shopping as shown below: Car No. ______

Trucks	Couplers & Dft. Gears	Body	Misel.

NOTE:

Cost of repairing Car

Direct Car Repairers	______
Strippers	______
Air Brake	______
Painters	______
Woodmill	______
Blacksmith	______
Misel.	______
Total	______
Material	______
Grand Total	______

Fig. 3—Reverse side of the card shown in Fig. 2—The cost figures are shown on this form

the number remaining to be repaired is shown so that there is no excuse for material to be ordered in excess of the requirements for any particular series of cars.

In the case of some series, such as composite stock cars, a general repair is not usually required and such cars are cared for with intermediate repairs. Other classes of equipment receive intermediate repairs during

Specialized Repair Program as of November 1, 1929

Series of cars	Date built or last general repairs	Years service life expected	No. owned Jan., 1929	Shops where repairs will be made	Date repairs will begin	Date repairs will be completed	Cars repaired per day	No. car men	Time to repair series	Character of repairs	Cars to be repaired after Nov. 1, 1929
10000 to 10999 85000 to 85749	1916-1927	10	1,726	Tipton, Ind.	Balance of these cars will be repaired as they appear on Tipton repair track.						51
30750 to 31749	1923	5	999	Frankfort, Ind.	*	1-1-29	2.7	10	2 mo.	Periodic	735
					7-15-30	1-1-31	5.0	22	5.5 mo.	Periodic	596‡
99000 to 99449	1919	12	450	Frankfort, Ind.	10-1-29	1-1-30	1.0	10	2 mo.	General	431
					1-1-30	7-15-30	2.0	22	7.5 mo.	General	375‡
97000 to 97999	1914	10	978	Frankfort, Ind.	*	1-1-31	.75	11	14 mo.	General	599
					1-1-31	7-1-31	2.25	31	6 mo.	General	325‡
1000 to 1208 46 to 146 206 to 292	Various	2	219	Frankfort, Ind.	*	†	.75	14	†	General	
3000 to 8299 91800 to 91949 92300 to 92799	1902-1910	2½	2,448	Conneaut, Ohio	*	†	2.5	20	†	General	
18000 to 18999 86500 to 86749 86750 to 86756	1915-1917	10	1,234	Conneaut, Ohio	*	3-1-30	.9	14	4 mo.	General	104
19000 to 19999	1923	5	997	Conneaut, Ohio	12-1-29	2-1-31	3.0	14	14 mo.	Periodic	997
20000 to 20999	1924	5	995	Conneaut, Ohio	2-1-31	4-1-32	3.0	14	14 mo.	Periodic	995
70000 to 70449	1923	5	449	So. Lorain, Ohio	*	12-1-30	.86	9	13 mo.	Heavy	315
17000 to 17999 25000 to 29299 80000 to 84999 86000 to 86198 (Repr. Steel Underframe)	1901-1910	8	4,926	Stony Island, Chicago	*		1.5	23	32 mo.	General	3,763
				Lima, Ohio	*	4-1-32	1.2	16			
				Tipton, Ind.	*		3.0	30			
							5.7	69			

* Indicates cars are now undergoing repairs. † Indicates cars will be continuous over an indefinite period. ‡ Number of cars to be repaired as of date repairs will begin.

the interval between general repairs. An intermediate repair is necessary principally for sandblasting and painting. In most cases the life of the paint is less than the life of other parts of the car. Painting at the proper time also extends the life of those parts of the car exposed to the elements.

General instructions covering the manner in which series of cars shall be repaired are furnished by the master car builder. This makes for uniformity of repairs in instances where a similar series of car is being repaired at more than one shop. At the time a car is given specialized general repairs it is the intention to make repairs to the car in such manner as to extend the life of the car to the next shopping period. Efforts are made to get the highest-quality material for use in repairs to these cars consistent with service requirements. In the interest of economy second-hand material is used when advisable. It is, however, the policy of the company to use on cars receiving specialized repairs material which is of such quality as to prevent the car from appearing on repair tracks because of material failure before the expectancy of service life has been attained. It is the desire of the management,

No. Pos.	Description	Board Feet	Price	Total Cost
	Side Belts 2½X4X12'			
	Side Belt Caps 1X4X16			
	End Belts 4X5X8'6"			
	Dead Wood 7X10X3'			
	Step Board 1¾X9X30"			
	Turn Buckle Lock 1¾X2½X7'			
	Front Door Stops 2X2½X8'			
	Floor Boards 1¾X5¼X9'1"			
	Floor Boards 1¾X5¼X9'4"			
	Floor Boards 1¾X7¼X9'1"			
	Floor Boards 1¾X7¼X9'4"			
	End Lining 1¾X5¼X7'10"			
	End Lining 1¾X7¼X7'10"			
	End Lining 1¾X5¼X7'5"			
	End Lining 1¾X7¼X7'5"			
	End Lining 1¾X5¼X8'6"			
	End Lining 1¾X7¼X8'6"			
	Sheathing bds.13/16X3¼X8"			
	Sheathing bds.13/16X3¼X9'			
	Sheathing bds.13/16X5¼X9'			
	Sheathing bds.Door 13/16X3¼X8'			
	Sheathing bds.Door 13/16X5¼X8'			
	Lining bds.13/16X5¼X16'			
	Lining bds.13/16X3¼X16'			
	Lining bds.13/16X3¼X8'6"			
	Lining bds.13/16X5¼X8'6"			

Fig. 5—Sample form of lumber material bill

that each car receiving specialized general repairs be equal in service life and quality to a similar new car.

Accurate Records Control Operations

A historical record of every car receiving specialized repairs is maintained on the form illustrated in Figs. 2 and 3. This form varies to suit the various types of equipment undergoing repairs at different shops. By the use of this form an accurate record of all costs in connection with repairs to the individual cars is maintained. Information pertaining to the principal repair items, paint, weather conditions, additions and betterments and man-hours are developed and recorded upon the completion of repairs to any car receiving specialized repairs.

The historical record on this form is in addition to the usual historical record maintained for accounting purposes. Fig. 4 illustrates a report form which varies for each shop and, in addition to the force assigned to specialized repairs, shows some information relating to other car-repair forces. This report is made on the last working day of each week and, with the form illustrated in Figs. 2 and 3, constitutes a check on the performance of the men assigned to specialized repairs and furnishes complete information on the production and costs of

LIMA, OHIO.
Week Ending______ 19___

ASSIGNMENT OF CAR REPAIRMEN:

	REPR.	APPT.
Light Repairs (Days)	____	____
" " (Nights)	____	____
Flour, Grain & Feed	____	____

Miscl. Performing:

SPECIALIZING 40-TON H&B BUILT BOX CARS.

Trucks	____	____
Frame	____	____
Floor, Sheathing and lining	____	____
Ends, S.A.& Trim	____	____
Roofs & Doors	____	____
Total	____	____

Note: On reverse side of this form list name, check number and spot position of each man specializing on general repairs.

TOTAL AUTHORIZED CAR REPAIRMEN ____
" " " APPRENT. ____

NUMBER OF CARS TURNED OUT ON SPECIALIZING TRACK______
AVERAGE DAILY OUTPUT____CARS.

Note: List numbers of cars turned off specialising tracks on back of this form. Cars shown must agree with cars reported on individual car report form ED-M 165 and must be repaired for 6 years service.

The following assignments must not be changed without authority of Master Car Builder:

40-ton H&B Built S.U.F. Box Cars - 16 men
Flour cars - 11 men

Minimum Daily Output
General Repair 40-ton H&B Built S.U.F. Box Cars 1.2
Flour Cars 4.5 cars

General Foreman.

Form La 2.
Rev. 8-1-28

Fig. 4—Weekly report of car-repair forces

making such repairs. Additional records are also maintained at the various shops which show the extent of repairs necessary for the complete rehabilitation of various cars held for general or heavy repairs.

Cars of the series indicated for specialized repairs are not held at a shop for repairs so long as they are serviceable for any commodity loading. They are maintained for the highest grade commodity loading through light repairs as long as possible before a reduction in the quality of loading is permitted. Often these light repairs consist only of washing the cars or the removal of nails from the interior.

Each car, after having received specialized general repairs, is carefully inspected by the shop supervisors and the legend "S.G.R.," location and date are stencilled on the car at a stated location to indicate that the car has received specialized general repairs. A car bearing this legend cannot receive general repairs within the life period without special authority from the master car builder.

Items of material used in cars undergoing repairs are checked by material checkers on standard A.R.A. forms at the car. A master form, which shows all of the items of material in one car of the series which is undergoing repairs at that shop, is maintained in the car foreman's office. This form indicates the price per unit of the various items and other information relating to the material which is necessary in arriving at

costs. Additional forms, which show the material items but not the other information, are then made up from information furnished by the material checker. Prices, weights, etc., are taken from the master form and the necessary extensions and additions made. The material cost arrived at in this manner is then shown on the form illustrated in Fig. 3. A sample sheet from the material record form is illustrated in Fig. 5. Labor items in connection with repairs are furnished by the piecework timekeeper and are taken from the piecework records.

While other roads have done some work in connection with the scheduling of freight cars on definite repair cycles none were known which would suit the conditions of this road. It was, therefore, necessary to work up a program adapted to the requirements. It has been found that the program originally adopted is very close to that which later developments show to be necessary and a minimum of changes have been made in the original program.

Consideration is Given to the Time Required to Make Repairs

In establishing production requirements at the various shops, consideration was given to the hours required to make repairs to the various types of equipment. All repairs are made on the position plan. In some cases the cars are moved from position to position and in other cases the men are moved from car to car. Local conditions govern the set-up of man power. All men specialize in their work and naturally become very proficient. The forces are maintained in balance so that there is no more lost motion than necessary between positions—the work being so distributed at all times that the daily production requirement of each position requires a full day's work from each assigned man.

Conditions on other roads are constantly under investigation and advantage is taken of new ideas wherever it is possible to demonstrate the efficiency of the idea.

No direct saving in the cost of repairing cars has developed as yet. As a matter of fact the cost per car for the first 10 months of 1929 is higher than 1925. Some of the increase is due to higher labor rates since 1925 and to the additional cost of repairing cars for a definite expectation of life rather than repairing them for limited service. It is expected, however, that after a sufficient number of cars have been repaired and returned to service the added service life given to the cars by the present repair program will decrease the maintenance costs appreciably in future years.

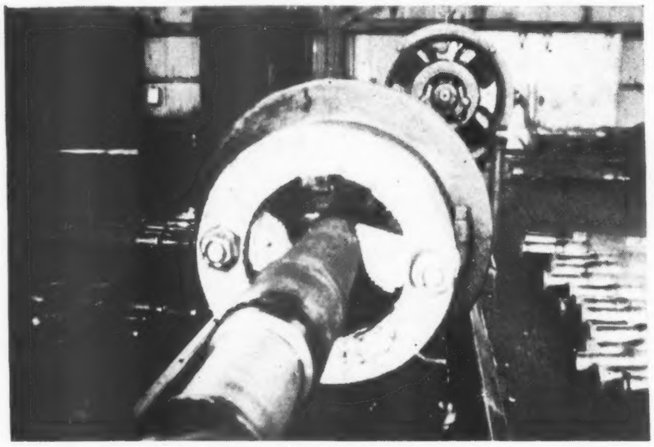
A Floating Lathe Dog for Car Axles

By W. J. Davidson

A PRESSURE-equalizing floating drive has recently been developed at the A. C. L. shops at Waycross, Ga., for use on equipment where machining, grinding, rolling and burnishing is done with the work driven on centers in one direction. The drive is designed to accommodate irregular and eccentrically shaped axles and, being full-floating, it maintains an equalized positive pressure at the points of contact between the dogs and the axle.

When the drive was applied to hollow-spindle lathes the use of clamps with driving dogs attached was eliminated and production was increased 12 per cent. The device will handle all sizes of A. R. A. axles with $4\frac{1}{4}$-in. by 8-in., to $6\frac{1}{2}$-in. by 12-in. journals, inclusive, without requiring any adjustment. It produces work of a superior finish because it completely eliminates the chatter experienced with the clamp method. Work of an inferior quality produced by the use of clamps is almost entirely attributable to slipping dogs when the machine is making heavy cuts. The high-grade quality of the work resulting from the use of the floating device is due to the fact that when heavy cuts are made the resistance between the dogs and the work increases and chattering stops entirely.

The removal and application of a job has been ma-



The floating drive applied to an axle lathe

terially simplified. The hard and tedious work of removing and applying heavy clamps has been eliminated making a light job out of an arduous task. There are no bolts, screws or nuts to be adjusted and it is only necessary to set the dogs in driving or release positions, as the case may be.

The device has also been applied to a Putman gap lathe which is used for machining cut journals with wheels applied. By its use on the split-drive machine, equal if not better results have been obtained as compared with the hollow-spindle machine application. Production has been increased to a considerable degree because the device eliminates the necessity of handling heavy clamps and decreases the time for removing and setting up the job. When using this drive it is only necessary to place the dogs in release position, split the counterbalanced drive, remove the wheels, roll another pair of wheels into the machine, close the split drive and place the dogs in driving position.

This full-floating, pressure-equalizing drive is simple, efficient and practically indestructible. It requires less space than the clamps formerly used and it incorporates several safety features which prevents any damage to the machine if it is started without a job in place.

ACCORDING to a recent announcement, MacDonald Brothers Engineering Laboratories, Inc., Boston, Mass., will erect at 1500 Oakman boulevard, Detroit, Mich., what is expected to be one of the largest and most complete machinery libraries in America, if not in the world. Detailed information concerning the machines and tools in use in all industries will be available at this library, which will also contain a permanent exhibit of all kinds of machine tools and allied supplies.

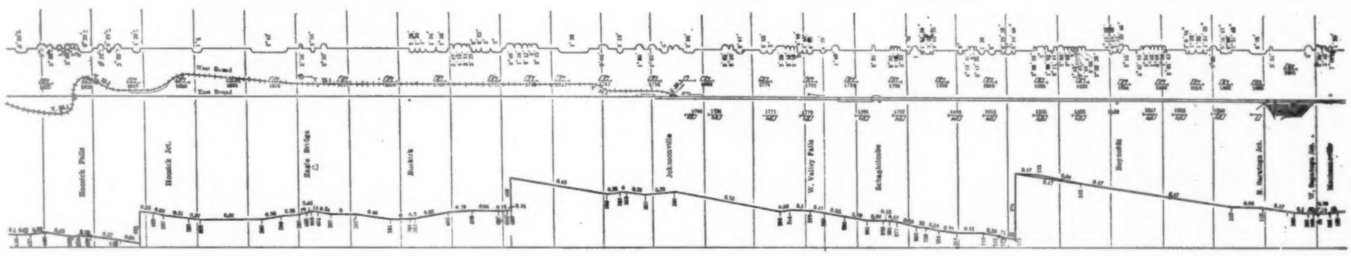
Road Tests of the Auxiliary Locomotive

Starting and stalling tests in road service described in a paper by George W. Armstrong presented at A. S. M. E. annual meeting

A PAPER on Locomotive Auxiliary Power Mediums, by George W. Armstrong, Bethlehem Steel Company, describing the results of a number of dynamometer-car tests of the Bethlehem auxiliary locomotive on the Boston & Maine, was presented by the Railroad Division, American Society of Mechanical Engineers, at the annual meeting of that society, which was held at New York, December 2 to 6. Included in this paper was a report of the plant tests which were conducted by the Bethlehem Steel Company with the cooperation of the Pennsylvania, in the locomotive testing plant at Altoona, Pa. The results of these tests were reported in an article which appeared in the November, 1928, issue of the *Railway Mechanical Engineer*, page 620. The following abstract contains only the report of the road test on the Boston & Maine.

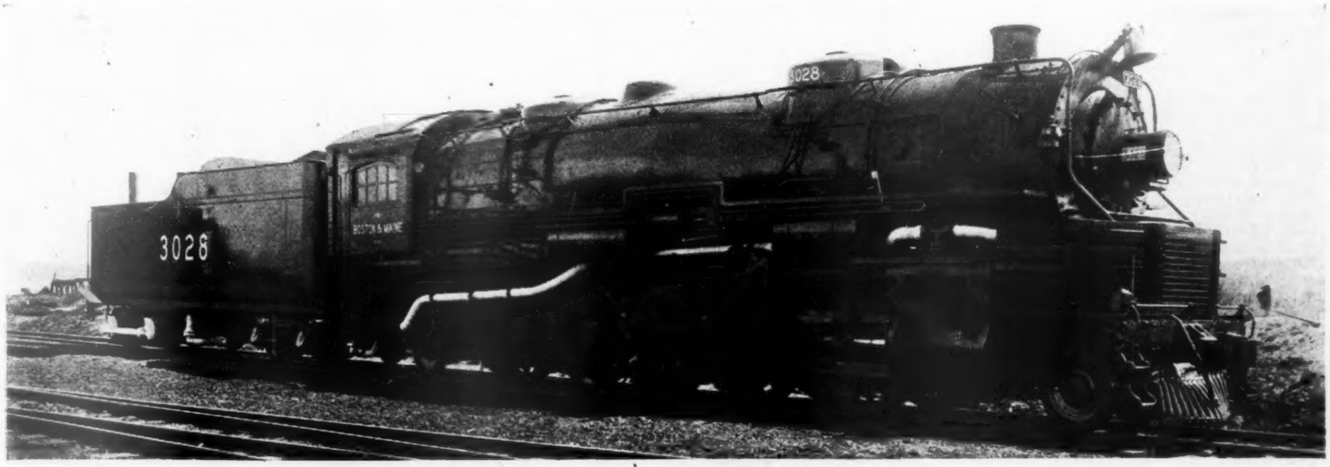
Service, the only commodity which the railroad has to sell, demands rapid transportation. Freight trains today are being run at speeds comparable with passenger schedules of not so many years ago. This has brought into existence, a locomotive with large driving wheels, 69-in. and 73-in. wheels being common for many recent freight locomotives, as contrasted with 57-in. and 63-in. wheels of 10 and 15 years ago.

Along with this trend is the desire to secure the maximum tractive force permitted by the allowable weight on the drivers, which has resulted in a gradual lowering of the factor of adhesion, or ration of driving-wheel weight to cylinder tractive force. The combination of these two factors has resulted in a locomotive with high sustained power at speed, due to the boiler capacity combined with the lowered piston speeds, and at the same time, an engine of greater tendency toward slipping.



Condensed profile and alinement of the track over which the road tests of the Bethlehem auxiliary locomotive were made

The hauling limitations, consequent upon high-wheel, high sustained power locomotives, without excessive wear and tear of machinery, and undue delay in accelerating frequently becomes the starting load rather than the road hauling load. An auxiliary power medium permits the locomotive to accelerate promptly and start a train, which is well within the ability of the locomotive to handle after once under way. Early attempts at auxiliary power utilization as previously men-



Boston & Maine 2-10-2 type locomotive used in the dynamometer tests

tioned, wholly aside from any inherent structural weaknesses, failed due to the limitations of steam production.

The growth in the size and capacity of locomotives has resulted in a boiler of proportions such that a reserve capacity is available at slow speeds for auxiliary power use. The boiler of a locomotive in its design must be considered in relation to the steam requirements at speed. Generally considered, experience has shown that maximum steam requirements and maximum horsepower for superheated-steam locomotives occur around a piston speed of 1,000 ft. per min.. It is this surplus boiler capacity which can be drawn upon, as reflected in road and test-plant results, and utilized in the operation of an auxiliary power medium.

Considering the various features of train operation, it is clear that the use of an auxiliary power unit which can be operated independently so as to be available when required for assisting the locomotive in starting the train and permitting considerable increase in train tonnage beyond that which could otherwise be handled, is closely related to economical train operation.

While railroad operation involves so many kinds of profiles and traffic conditions that no fixed rules can be laid down to indicate the various power arrangements that would be most efficient with respect to

Summary of Boston & Maine Dynamometer Tests

East Bound Operation

	Auxloco tonnage trips				Regular tonnage trips		
	No. 2	No. 4	No. 10	Average	No. 6	No. 8	Average
Feedwater heater or injector	F.w.h.	F.w.h.	Inj.		F.w.h.	Inj.	
Actual tons, incl. dynamometer car and caboose	3403	3502	3496	3467	2962	2952	2957
Loaded cars	62	74	63	66.3	57	63	60
Empty cars	2	8	1	3.7	4	2	3
Total cars	64	82	64	70.0	61	65	63
Allowed mileage trip	85	82	82	..	85	85	..
1000 g.t.m.	289.255	287.164	286.672	287.697	251.770	250.920	251.345
Elapsed time, h.m.s.	5–51–55	5–53–54	5–57–13	5–54–21	5–31–40	5–43–50	5–37–45
Deductions, h.m.s.	0–59–34	1–12–21	1–10–42	1–07–32	0–59–55	1–14–13	1–07–04
Running time, h.m.s.	4–52–21	4–41–33	4–46–31	4–46–48	4–31–45	4–29–37	4–30–41
Speed per train hour:							
Elapsed	14.5	13.9	13.8	..	15.4	14.8	..
Running	17.4	17.5	17.2	..	18.8	18.9	..
Coal—working distance	16,352	17,854	21,600	18.602	15,686	16,048	15,867
Total trip	20,554	21,390	24,908	22,284	18,538	20,478	19,508
Coal per 1000 g.t.m.	71.05	74.48	86.88	77.46	73.63	81.61	77.69
1000 g.t.m. per train hr.:							
Elapsed time	49,320	48,680	48,150	48,713	45,570	43,790	44,652
Running time	59,350	61,200	60,030	60,188	55,560	55,830	55,718
Running time:							
Mechanicsville—Test m.p. 180	0–56–25	0–51–56	0–53–07	0–53–46	0–41–24	0–41–40	0–41–32
Test m.p. 180—Eagle Bridge	0–50–16	0–43–46	0–50–19	0–48–07	0–37–23	0–43–47	0–40–35
Eagle—North Adams	1–11–20	1–30–20	1–27–24	1–23–01	1–23–30	1–17–00	1–20–15
Electric operation	0–30–15	0–22–44	0–20–25	0–24–28	0–19–46	0–19–46	0–19–27
East Portal—Greenfield	......	1–12–47	1–15–26	......	......	......	......
East Portal—East Deerfield	1–24–05	......	......	1–17–26	1–30–20	1–27–24	1–28–52
Actual distance, feet:							
Mechanicsville—North Adams	246,885	246,540	250,869.5	248,098	251,587.5	246,920	249,253
Auxloco operation	26,078′	15,576′	33,615′	25,089.7	......	......	......
Time auxloco operation	0–40–46	0–30–03	0–47–35	0–39–28	......	......	......
Per cent auxloco operation:							
Mechanicsville—North Adams	......	......	......	......	......	......	......
Distance, per cent	10.56	6.32	13.4	10.1	......	......	......
Running time	22.85	16.28	24.94	21.65	......	......	......
Average tractive force at 1000 ft. intervals.	51,980	52,681	53,200	52,677	44,360	42,616	43,478
Test m.p. 180—Eagle Bridge	41,446	40,572	42,240	41,403	33,753	34,390	34,069
Eagle Bridge—North Adams	32,905	35,685	34,913	34,525	30,554	29,141	29,856
Number of stops	5	6	7	6	8	6	7

West Bound Operation

	Auxloco tonnage trips				Regular tonnage trips		
	No. 1	No. 3	No. 9	Average	No. 5	No. 7	Average
Feedwater heater or injector	F.w.h.	F.w.h.	Inj.		F.w.h.	Inj.	
Actual tons, incl. dynamometer car and caboose	2384	2404	2396	2394.7	2091	2066	2078.5
Loaded cars	27	22	22	23.7	5	17	11
Empty cars	54	69	75	66.0	86	73	79.5
Total cars	81	91	97	89.7	91	90	90.5
Allowed mileage trip	84	84	84	......	84	84	......
1000 g.t.m.	200.256	201.936	201.264	201.152	175.644	173.544	174.594
Elapsed time, h.m.s.	5–52–20	6–49–02	6–10–56	6–17–26	5–04–10	5–02–47	5–03–28
Detentions	1–06–41	1–48–00	1–10–25	1–21–42	0–37–50	0–51–31	0–44–40
Running time	4–45–39	5–01–02	5–00–31	4–55–44	4–26–20	4–11–16	4–18–48
Speed per train hour:							
Elapsed time	14.3	12.3	13.6	......	16.6	16.6	......
Running time	17.6	16.8	16.8	......	18.9	20.0	......
Coal—Working distance	11,712	12,530	15,210	13,151	10,952	11,560	11,256
Total trip	16,522	17,796	21,010	18,442.7	15,154	16,522	15,838
Coal per 1000 g.t.m.	82.50	88.12	104.39	91.68	86.27	95.38	90.71
1000 g.t.m. per train hr.:							
Elapsed time	34,105	29,620	32,560	32,979	34,650	34,400	34,518
Running time	40,150	40,250	40,180	40,809	39,570	41,240	41,690
Running time							
East Deerfield—Test Sig. 1157	0–55–00	1–04–56	0–52–37	0–57–31	0–47–38	0–50–04	0–48–51
Test to East Portal	1–20–35	1–20–02	1–44–21	1–28–19	1–20–31	1–16–37	1–18–34
Electric operation	0–25–00	0–29–25	0–25–52	0–26–46	0–21–25	0–23–00	0–22–13
North Adams—Mechanicsville	2–05–04	2–06–39	1–57–41	2–03–08	1–56–46	1–41–35	1–49–10
Actual distance—ft.:							
East Deerfield—East Portal	166,212	165,953	165,543	165,903	168,718	167,860.5	168,289
Auxloco operation	18,551	22,804	22,584	21,313	......	......	......
Time—Auxloco operation	0–29–18	0–36–13	0–44–17	0–36–36	......	......	......
Per cent auxloco operation:							
East Deerfield to East Portal							
Distance	11.16	13.75	13.62	12.86	......	......	......
Running time, per cent	21.55	25.03	28.17	26.93	......	......	......
Average tractive power at 1000 ft. intervals:							
East Deerfield to test	30,840	34,630	35,005	33,478	30,338	29,965	30,153
Test to m.p. 120	59,785	62,615	65,010	62,510	54,390	54,123	54,257
M.p. 120 to East Portal	31,680	33,955	38,405	34,653	31,710	29,970	30,824
No. of stops	5	7	6	6	5	4	4.5

utilization of auxiliary power and regular helper service, there are few operations to which the auxiliary locomotive cannot be adapted on a very profitable basis.

Permits Increasing Train Tonnage

Where ruling grades are relatively short (momentum or otherwise), the use of an auxiliary power unit permits increasing the train tonnage an amount over the entire division consistent with that for a locomotive of a tractive force equal to that of the combined auxiliary and main locomotive.

Where the ruling grade is compensated by means of assistant or helper-engine service, the next heaviest grade of the district then becomes the ruling grade, and where conditions warrant, tonnage rating can be arranged with reference to the capacity of the main locomotive and auxiliary locomotive on the secondary grade. A condition such as the foregoing would undoubtedly require auxiliary power use in negotiating the primary ruling grade, and might require auxiliary power use on helper locomotives if sufficient differential existed in gradient.

Operating conditions with heavy pusher ruling grades, which do not present long continuous uniform gradients, afford ample opportunity for increasing train tonnage through the use of an auxiliary power medium which is applied only to the helper locomotives.

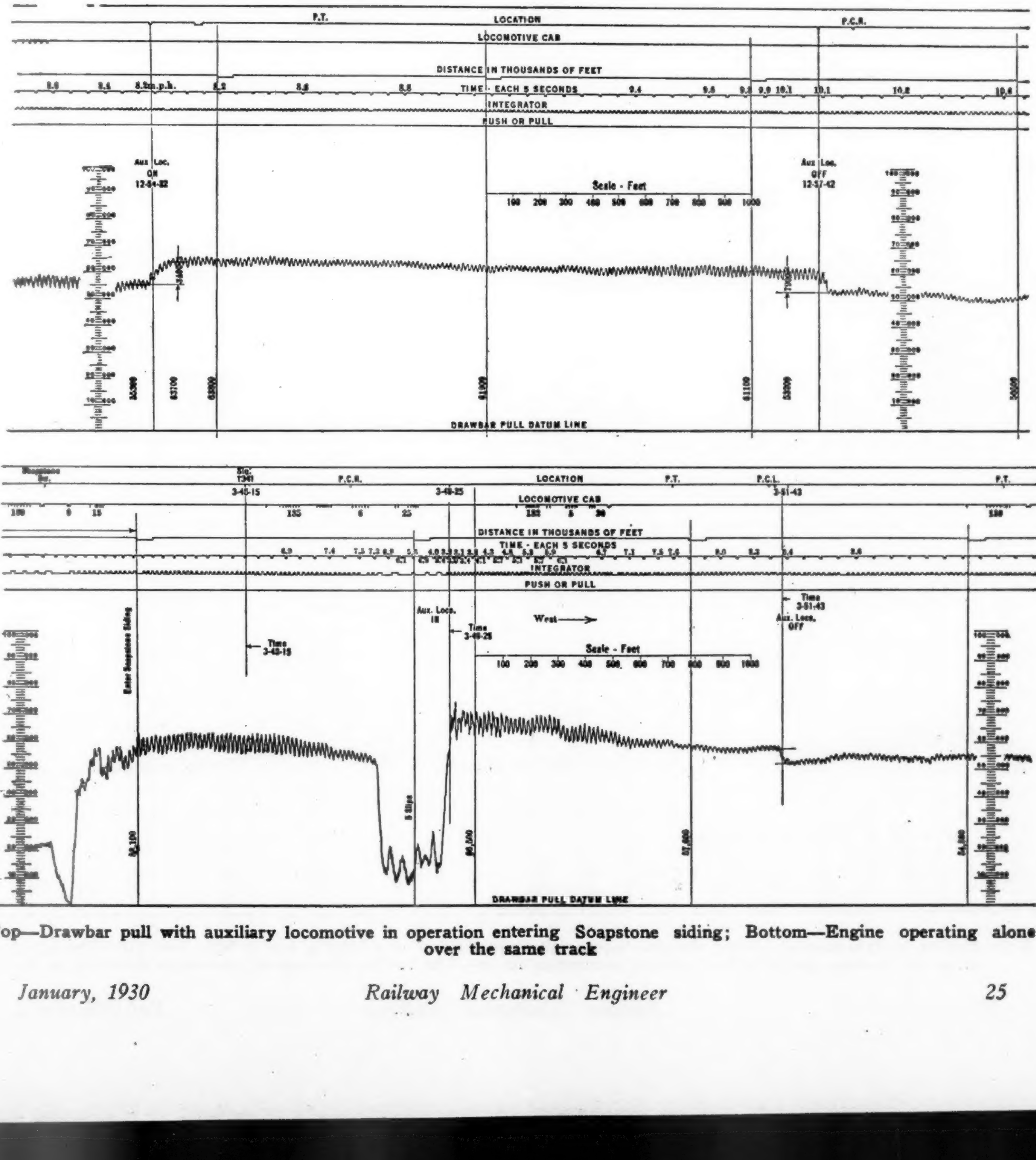
Dynamometer-Car Tests

Low-grade operating divisions permitting high-speed operation to which high-capacity power with large driving wheels is adapted can, as previously outlined, be negotiated by increased tonnage trains through the use of the auxiliary power unit to start the train.

Many locomotives have sufficient boiler capacity to support two auxiliary locomotives where only short periods of operation of the auxiliary units are required. This is especially an important feature in regard to hump engines, so as to permit handling trains with a

Table I—Log of road test No. 3

	Pressure			Water		
Time	Boiler	Steam chest	Auxiliary locomotive	level in glass	Superheat	Reverse lever
10-08-30	193	180	175	3/8	540	30
10-09-36	185	167	150	1/2	550	30
10-14-30	187	170	150	1/2	570	28
10-18-35	185	172	150	3/8	590	25
10-27-05	185	168	150	3/8	590	25
10-29-18	187	165	150	3/8	580	20
10-34-20	185	170	150	3/8	580	20
10-35	184	163	150	1/2	580	25
10-38-30	188	165	150	1/2	580	23
10-41	183	168	150	1/2	575	23



Top—Drawbar pull with auxiliary locomotive in operation entering Soapstone siding; Bottom—Engine operating alone over the same track

single locomotive without the necessity of cutting them.

Dynamometer-car tests were run on the Boston & Maine during the spring of 1927, which give a good picture of what can be accomplished under service conditions.

The tests were run between Mechanicsville, N. Y., and East Deerfield, Mass., over the Berkshire division of the Boston & Maine. In both directions, there is an up grade operation to the Hoosac tunnel piercing the Hoosac Mountains, and through which trains are handled by electric locomotives.

A comparative picture of road operations on the section between Mechanicsville and Hoosick Falls as revealed by these dynamometer tests is shown in one of the charts. This shows the profile of that section of track.

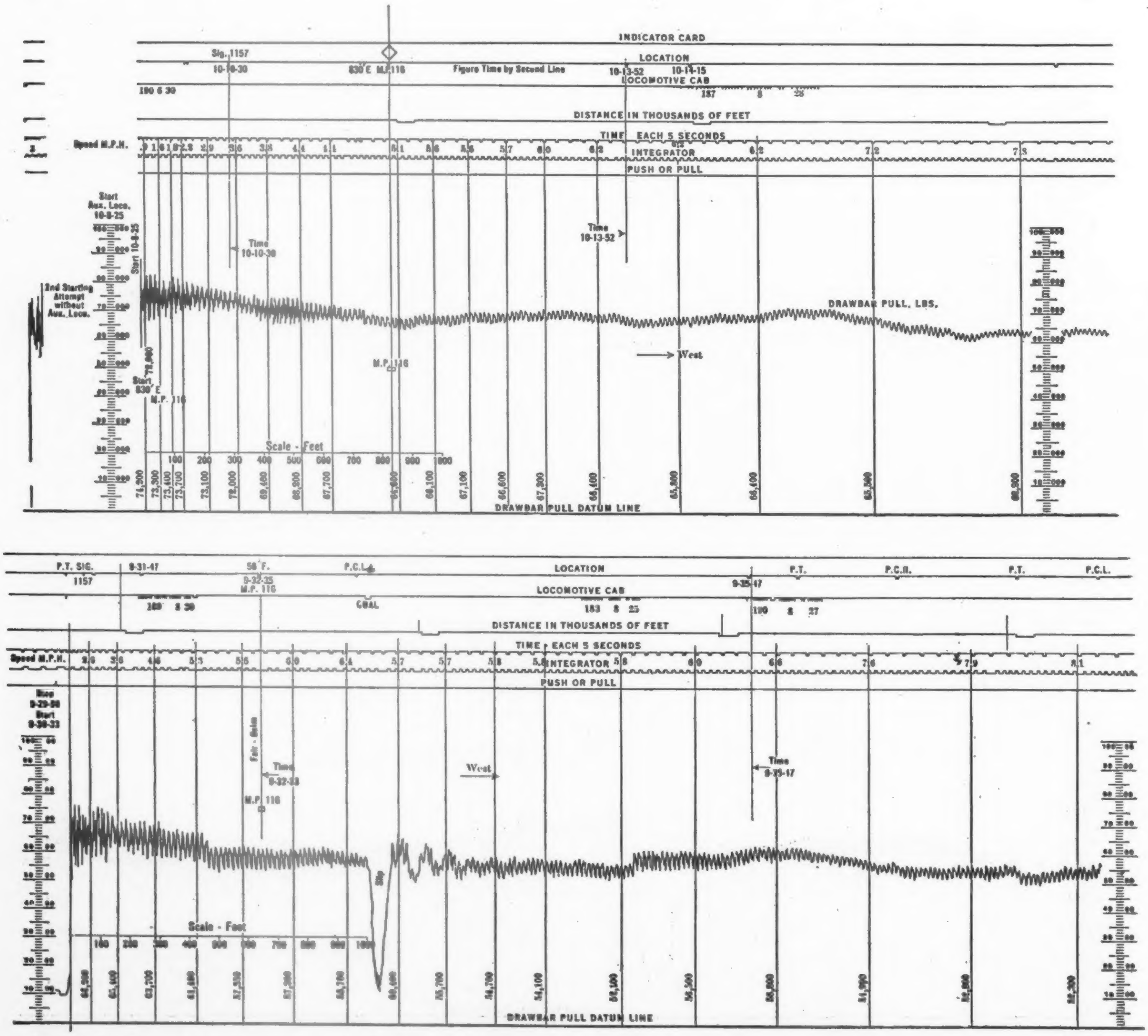
In demonstrating the value of the auxiliary locomotive as well as to answer satisfactorily whether tonnage could be handled, all test trains were stopped on the ruling grade at the worst operating condition and handled from there. Further, all tonnage trains were started with the use of the auxiliary locomotive only to supplement the locomotive after three stalling starts were made with the locomotive only.

East-bound traffic is of major importance on tonnage trains, being the prevailing movement. The operation in this direction showed an increase in the gross ton-miles per train-hour, the average being 60,188 for auxiliary locomotive operation as against 55.718 for the locomotive only, an increase of 8 per cent.

Table II—Acceleration from start at signal 1798

Test number Engine and auxiliary locomotive	Distance from start, ft.	Time from start, sec.	Speed, m.p.h.
2	1000	147	6.5
	2000	244	7.9
4	1000	167	7.0
	2000	255	8.6
Engine only			
6	1000	190	6.3
	2000	285	8.7
8	1000	169	6.9
	2000	259	7.3

West bound there was a slight loss in gross ton-miles



Reproduction of dynamometer charts showing comparative performance in a starting test at Mile Post 116—The top chart shows the drawbar pull with the auxiliary locomotive cut in—The bottom chart shows the engine operating alone

per train-hour, an average of 40,809 being secured under extra tonnage operation compared with 41,690 under regular operation, a loss of 2.2 per cent.

No difficulty was experienced at any time in maintaining the steam pressure on the locomotive during the time the auxiliary locomotive was in operation. The log of boiler, steam-chest, and auxiliary steam-chest pressures, as well as water-level, super-heat, and reverse-lever position are given in Table I for test No. 3 over the section from the start at signal 1157, Mile Post 116 to 120 with the auxiliary locomotive operating over the entire section. The reason for the drop in pressure at the last reading was to avoid lifting the safety valve after the engine was partly shut off passing Mile Post 120.

The four dynamometer charts shown, illustrate the value of an auxiliary locomotive. Entering Soapstone siding, the locomotive ordinarily could handle the train, but in rounding the reverse curve just beyond the entrance switch, a bad rail condition was encountered. Owing to water dropping from a ledge of rocks onto the right-hand rail, the locomotive slipped badly upon reaching this spot. The speed was reduced from 7½ m.p.h. to 3 m.p.h. in 45 sec., and the locomotive would have stalled except for the fact that the auxiliary locomotive was cut in, and within a distance of slightly over 1,200 ft. accelerated the train from 3 m.p.h. to 8.4 m.p.h.

A typical use of the auxiliary locomotive to accelerate a train on a grade, and at the same time compensate for curvature on the grade, was while a train was being handled on a 0.47 per cent grade. The engine had just started on a short tangent beyond the last curve, so that the train was being handled around a number of curves. The use of an auxiliary locomotive in handling increased tonnage over a heavy grade is shown in a typical start with a regulation tonnage train from signal 1157, east of Mile Post 116 using the locomotive only, and the starting of an auxiliary locomotive extra-tonnage train from the same point. An additional drawbar pull of 10,000 lb. was needed to start this train over that which the locomotive alone developed in a stalling start. A steadier pull was secured by the use of the auxiliary locomotive and there was a decreased tendency of the main locomotive to slip.

Use of the auxiliary locomotive is shown in Table II, which gives the acceleration while handling regulation tonnage from signal 1798 near Mile Post 180. These records also serve to show the relative accelerating ability of the locomotive equipped with the auxiliary locomotive where the use of the auxiliary is continued beyond the point absolutely required to handle the extra tonnage train.

The use of an auxiliary locomotive from a bad water-plug stop is presented by the operating conditions at Johnsonville, N. Y., where the train is on a 0.55 per cent grade, and the engine dips over the crest of the hill and starts down a 0.39 per cent grade.

It is evident in the foregoing that the locomotive boiler fundamentally determines the utility of an auxiliary power medium. While a given locomotive boiler has a definite evaporative capacity, it must be conceded that this capacity cannot under present locomotive design be availed of at all speeds.

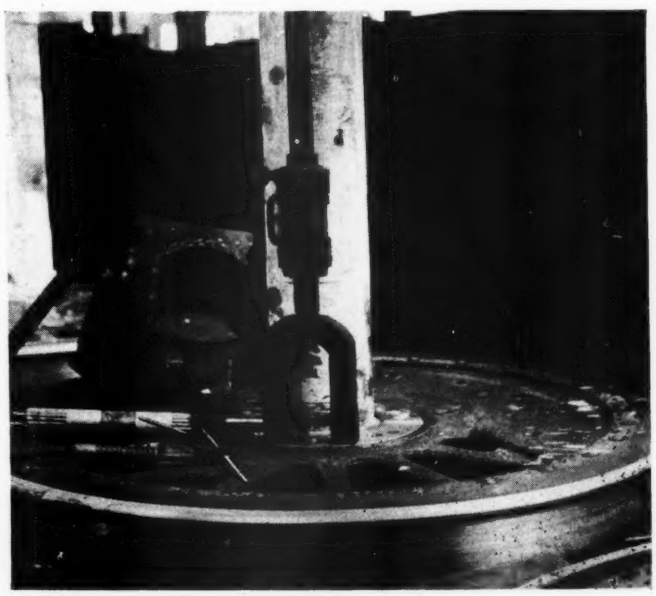
Stephenson in the early stages of locomotive development conceived the idea of employing the exhaust steam in a blast for the purpose of drafting the locomotive. This principle is still employed, and with the employment of the most efficient appliances of today, it represents a nearly ideal method for ordinary operation.

Draft is a function of combustion rate, and also of steam consumption and therefore exhaust, and the variation in the combination of variables is such that as an increased firing rate becomes necessary, the increased steam consumption, and therefore the exhaust, increases the draft so as to support the higher firing rate.

It must therefore follow that under certain conditions, the increased boiler capacity required for auxiliary power use must result from forcing the boiler beyond the normal capacity for that condition of working. Many attempts have been made to develop methods of induced and forced draft which will have the effect of making the boiler independent of engine working, and with the successful development of any such method, a greatly extended field for auxiliary power utility will be opened up.

Hub Liner Application

AN air-operated clamp is used to hold steel hub liners in position for electric welding to locomotive driving-wheel centers at the Canadian National locomotive shops at Transcona near Winnipeg, Man. This device consists of a fork end to span the hole to be welded, and a pneumatic holder-on with a heavy pipe extension to back up against the other wheel. The clamp can be easily and quickly moved from one hole to the other and holds the plate tightly in place during the welding operation. For the convenience of the operator and to assist him in doing a better job, it is found advisable to stand the driving wheels on end during the welding operation.



Effective method of holding hub liners while welding at the Transcona shops of the Canadian National

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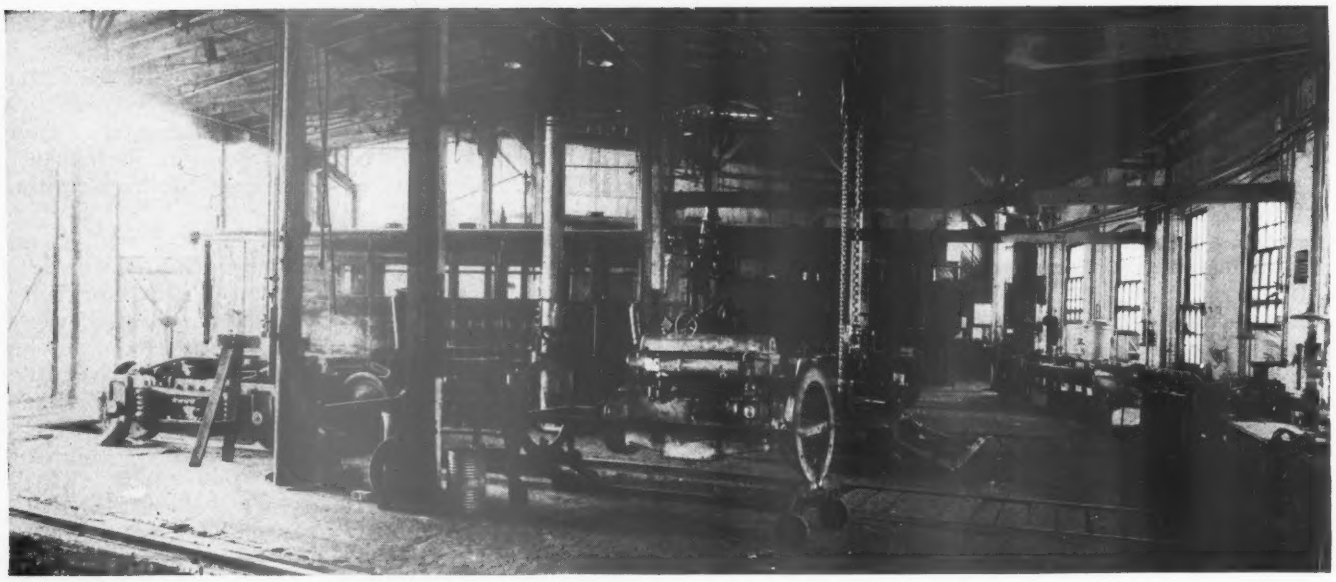
OESTERLEIN GRINDERS.—The Oesterlein Machine Company, Cincinnati, Ohio, has issued a new grinder booklet, entitled "Precision Features of Oesterlein Grinders," in which the outstanding features of Oesterlein grinders are described and illustrated in progressive steps. These grinders are designed primarily for the tool room, but are particularly adapted for certain types of light production work.



Interior view of the New York, New Haven & Hartford motor-car repair shop, New Haven, Conn.

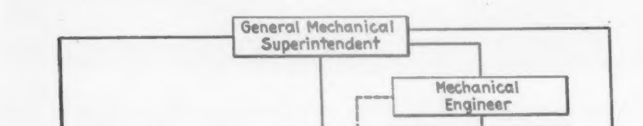
Maintaining Rail Motor Cars on the New Haven

Separate organization established in 1925 handles the work on 36 cars

By E. O. Whitfield

Supervisor, Rail-Car Inspection and Maintenance, New York, New Haven & Hartford, New Haven, Conn.

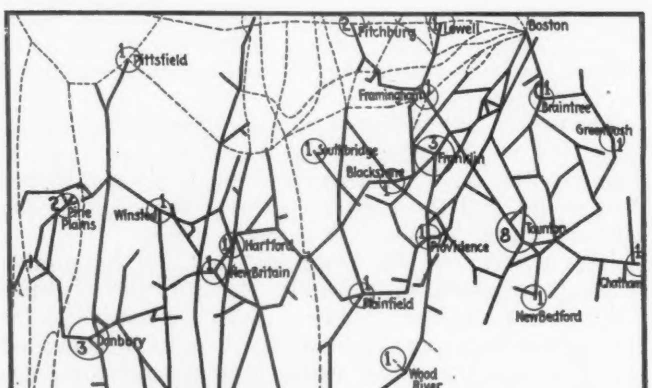
ALTHOUGH the New York, New Haven & Hartford purchased its first rail motor car as far back as 1922, it was not until 1925 that a separate organization was established for the inspection and maintenance of this type of equipment. The



The organization of the automotive division

first rail motor cars placed in operation on the New Haven, were three Mack units with mechanical transmissions and powered with 45-h.p. gasoline engines, which operate at 1,200 r.p.m. The fourth car was placed in service two years later.

In general, the attitude of the patrons toward this type of rail equipment was that of curiosity and some tolerance, especially when the first three mechanical-drive units were placed in service. This was prob-



Sketch map of the New Haven system showing the assignment of rail motor cars

ably due to their appearance, which was distinctly automotive. However, with the adoption of the conventional body standards, such as those used in the Sykes and Brill designs, the reaction on the part of the patrons has become favorable, especially with the provision of greater riding comforts and conveniences for the patrons.

At the present time, the new Haven operates 36 rail motor cars, which vary in age from eight to two years, as shown in the table. It will be noted that the progress in design and size of equipment was rapid. The rail motor cars bearing the road numbers 9004 to 9023, inclusive, and 9100 to 9111, inclusive, represent a group of 32 units which have definite standards. This feature has facilitated the solution of the maintenance problem to a considerable extent.

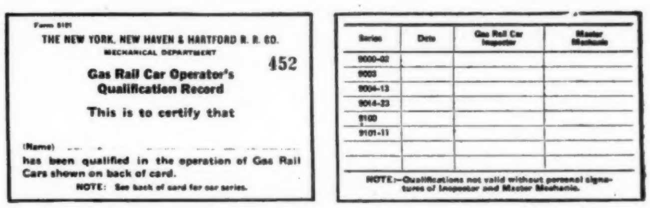
The Number, Type and Age of the Rail Motor Cars in Service on the New York, New Haven & Hartford

No. of cars	Type of car	Road No.	Length of service, yrs.	Transmission	Passenger capacity	Engine h.p.	Engine speed, r.p.m.
3	Mack	9000–9002	8	Mechanical	35	45	1,200
1	Waterbury	9003	6	Hydraulic	65	160	1,200
10	Sykes	9004–9013	5	Mechanical	45	130	1,600
10	Brill No. 65	9014–9023	4½	Mechanical	50	130	1,600
12	Brill	9100–9111	3½–2½	Electric	90	250	1,100

Organization for Motor-Car Maintenance on the New Haven

The present automotive maintenance organization consists of a supervisor of rail car maintenance and inspection, who reports directly to the general mechanical superintendent, and five specially qualified rail motor car inspectors, who report to the supervisor. The automotive division, as it is called, supervises the entire maintenance program at outside terminals, and the motor car repair shop at New Haven, Conn. It was found necessary to establish this separate organization, especially in view of the scattered assignment of cars, and the necessity of segregating upkeep and other work from locomotive maintenance. Naturally, this presented many different problems which were entirely new to the management.

Under the present system of organization, the motor car inspectors qualify operators, inspect cars, instruct and examine maintainers, assist in emergency repairs and in "trouble shooting". They also take care of general matters pertaining to motor car maintenance, and must be available to meet any emergency. The engineer of automotive equipment reports to the mechanical engineer. He cooperates with the supervisor of motor car maintenance and inspection in the elimination


Form 5101

THE NEW YORK, NEW HAVEN & HARTFORD R. R. CO.

MECHANICAL DEPARTMENT

452

Gas Rail Car Operator's Qualification Record

This is to certify that

(Name) ....

has been qualified in the operation of Gas Rail Cars shown on back of card.

NOTE: See back of card for car series.

Series	Date	Gas Rail Car Inspector	Master Mechanic
9000-02			
9003			
9004-13			
9014-23			
9100			
9101-11			

NOTE:—Qualifications not valid without personal signatures of Inspector and Master Mechanic.

Front and reverse sides of the operator's certificate of qualification

Testing an engine for lubricating oil leaks—The engine is mounted on a truck which can be rotated 360 deg. and is directly connected to an oil pump shown at the left

THE NEW YORK, NEW HAVEN AND HARTFORD RAILROAD COMPANY
Automotive Division

-M A I N T A I N E R S-
RECORD OF EXAMINATION

Name Instructed by

Examined by

Efficiency Rating Awarded at Time of Instruction %

Final Efficiency Rating after Examination: Cards............... %

Questionnaires...... %

Trouble Shooting.... %

Operation........... %

Intelligence........ %

Avg. general rating. %

Date Signed

Mechanical Inspector.

NOTE: Examiner must not be same person who instructed.

Form [illegible]

GAS RAIL CAR OPERATORS' QUALIFICATION RECORD

Name

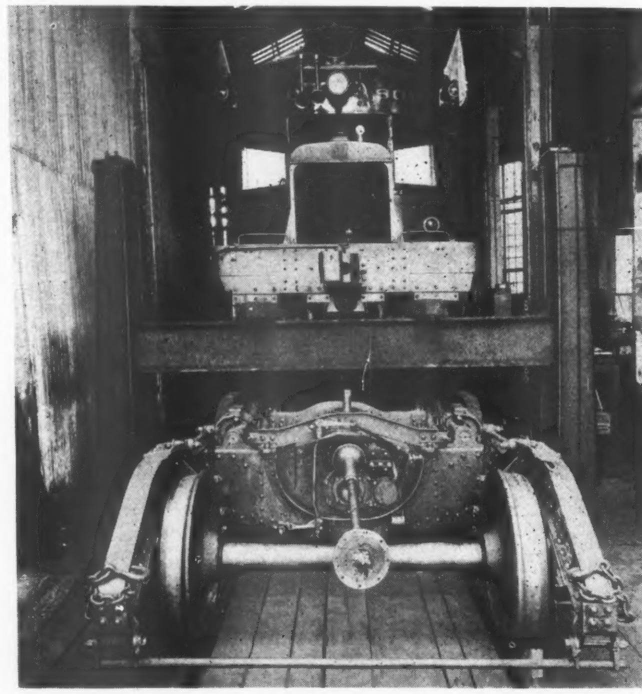
Division

Card No.	Master Mechanic	Inspector	9000-2	9003	9004-13	9014-23	9100	9101-11

Top—Report on maintainer's examination; Bottom—Operator's qualification record

It frequently occurred, previous to the establishment of the automotive division that several motor cars operating within a radius of a few miles, would come under the jurisdiction of several master mechanics. This meant a different group of maintainers for each unit, the large majority of which are not accustomed to work to the close tolerances of fits necessary in the maintenance of internal combustion equipment.

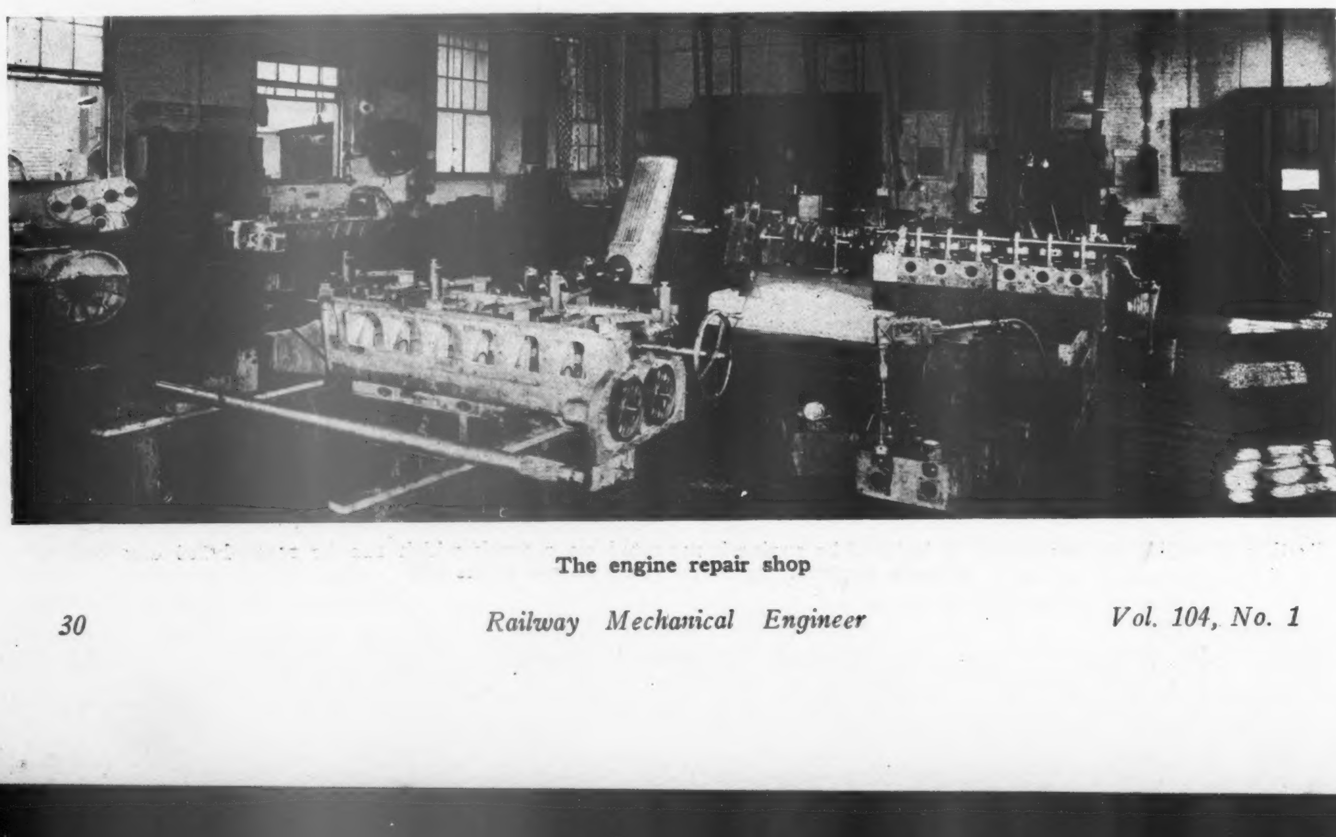
The organization of the automotive division made it possible to have motor cars which were operating over lines in two or three different divisions repaired by one group of qualified maintainers, all of whom report to one master mechanic. This officer is held responsible for the work performed by the men within his jurisdiction. In addition, each one of the motor cars assigned to this master mechanic is inspected once a week



Removing the power truck from a Brill No. 65 rail motor car—Whiting hoists are used in this operation

of design failures. All specifications pertaining to new equipment are prepared by the mechanical engineering department.

As shown on the sketch map, rail motor cars are assigned to many points scattered all over the system. These assignments extend as far west as Poughkeepsie, N. Y., east to Chatham, Mass., north to Fitchburg, Mass., and Pittsfield, and south to Bridgeport, Conn. This diversity of assignments, together with the fact that the facilities provided at terminals were built and equipped for maintaining steam motive power, created many problems with respect to the inspection and maintenance of rail motor cars.



The engine repair shop

by an inspector who has been especially trained for this work.

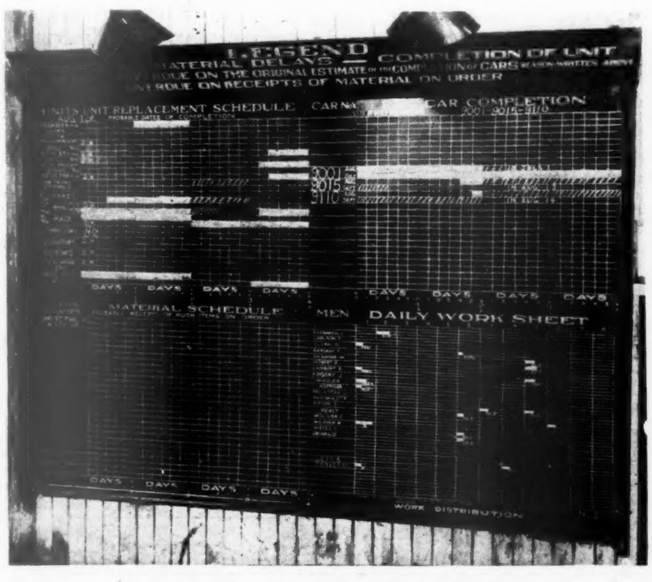
Methods Used in Supervision of the Automotive Division

A number of the illustrations show the different forms of reports and records used by the automotive division of the New York, New Haven & Hartford. To qualify as a motor car operator, each applicant is given a theoretical and practical test to demonstrate his ability to operate each type of motor equipment used by the railroad. The results of this examination are reported on Form 1057-W, which is shown in one of the illustrations.

Fuel-testing and carburetor repair bench

Each prospective operator is instructed in the operation of each class of equipment by a motor-car inspector.

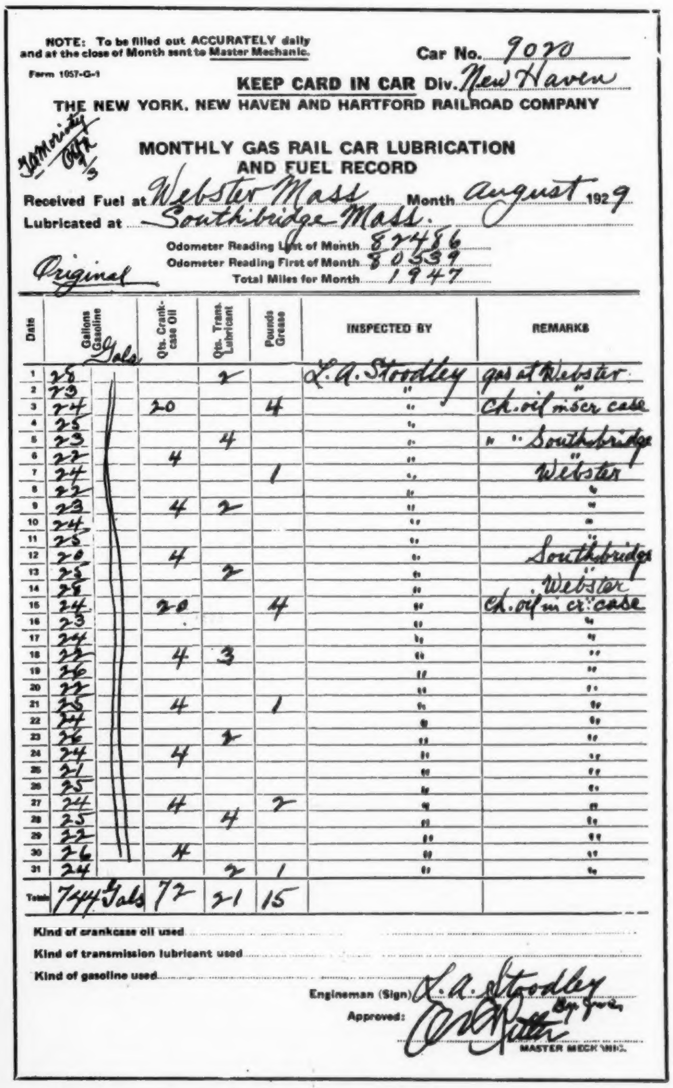
After qualifying, the operator is given a card, Form 5101 which certifies that he has qualified in the operation of the rail motor cars indicated on the back of the card. The reverse side of the operator's qualification card shows the class of equipment and the date on which the operator qualified to operate each type of equipment. It is made valid by signatures of the inspector who gave the instruction, and the master mechanic. The operator carries this card, which is 2½ in. wide by 4 in. long, with him at all times.



Shop schedule board at New Haven

Rail motor car operators are also given sufficient instructions in the operation of the various mechanisms to insure intelligent operation and to enable them to meet emergencies that are liable to occur in road operation. The requirements governing the qualification of operators are strictly enforced. Under no condition is an operator provided with a certificate of qualification until he is sufficiently familiar with his duties to satisfy the instructor.

One of the principal duties of the inspector is to instruct and train the maintainers. Each inspector must be sufficiently exacting in the performance of these duties to impress the mechanics with the need of making daily inspections of each unit in service to avoid the possibility of having a failure on the road. The Inspectors are required periodically to work an entire shift with each maintainer or group of maintainers and, while doing this, to check each of the items shown on Form 1057-M, which is shown in an illustration, as it is filled out by the mechanic doing the work. On the completion of this examination the inspector fills out the form, also illustrated, which is a report on the efficiency of the maintainer in the performance of his various duties, such as "trouble shooting", making and filling



NOTE: To be filled out ACCURATELY daily and at the close of Month sent to Master Mechanic.

Form 1057-G-1

Car No. 9070

KEEP CARD IN CAR Div. New Haven

THE NEW YORK, NEW HAVEN AND HARTFORD RAILROAD COMPANY

MONTHLY GAS RAIL CAR LUBRICATION AND FUEL RECORD

Received Fuel at Webster Mass Month August 1929

Lubricated at Southbridge Mass.

Odometer Reading Last of Month 82486

Odometer Reading First of Month 80539

Total Miles for Month 1947

Original

Date	Gallons Gasoline Gals	Qts. Crank-case Oil	Qts. Trans. Lubricant	Pounds Grease	INSPECTED BY	REMARKS
1	25		2		L. A. Stoodley	gas at Webster
2	23				"	"
3	24	20		4	"	Ch. oil mixer case
4	25				"	
5	23		4		"	" " Southbridge
6	22	4			"	"
7	24			1	"	Webster
8	22				"	"
9	23	4	2		"	"
10	24				"	"
11	25				"	"
12	20	4			"	Southbridge
13	25		2		"	"
14	28				"	Webster
15	24	20		4	"	Ch. oil in cr. case
16	23				"	"
17	24				"	"
18	22	4	3		"	"
19	26				"	"
20	22				"	"
21	25	4		1	"	"
22	24				"	"
23	26		2		"	"
24	24	4			"	"
25	21				"	"
26	25				"	"
27	24	4		2	"	"
28	25		4		"	"
29	22				"	"
30	26	4			"	"
31	24		2	1	"	"
Totals	744 Gals	72	21	15		

Kind of crankcase oil used

Kind of transmission lubricant used

Kind of gasoline used

Engineman (Sign) L. A. Stoodley

Approved: Master Mech'nic.

Monthly report of fuel and lubricating oil consumption

out reports, etc. In this connection, each maintainer is provided with instruction books pertaining to the various classes of motor equipment used by the New Haven and also with especially prepared sets of questions and answers arranged in the form of a catechism. This catechism serves to help the mechanic to become

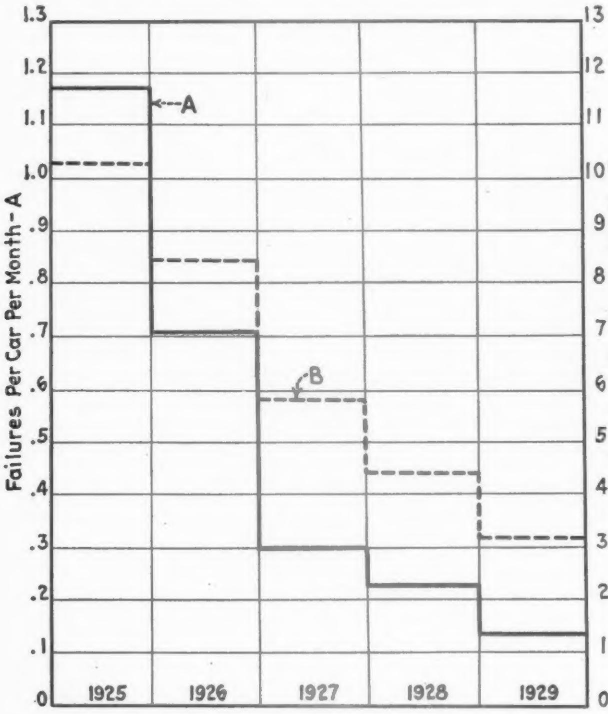
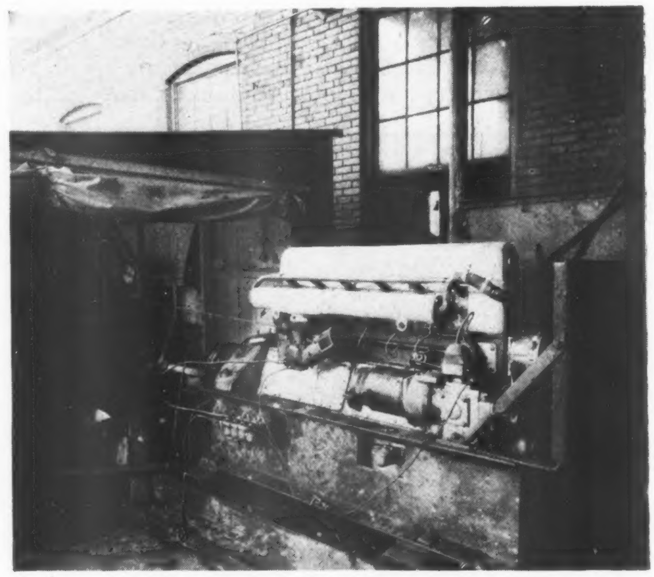


Chart showing the average failures per car and car-shop days per car from 1925 to 1929 inclusive

familiar with the work, and it is also designed to facilitate the work of instruction. Mechanics working on gas-electric cars are capable of making repairs to both the mechanical and electrical equipment, and it is not necessary to divide this responsibility among several men.

Each maintainer is required to fill in the Form 1057-M, which includes mechanical items for monthly, semi-monthly, weekly and daily inspections. This report applies to cars that have mechanical transmissions. It is sent at the end of each month to the master mechanic for his signature, and is forwarded to the supervisor of rail-car maintenance and inspection.

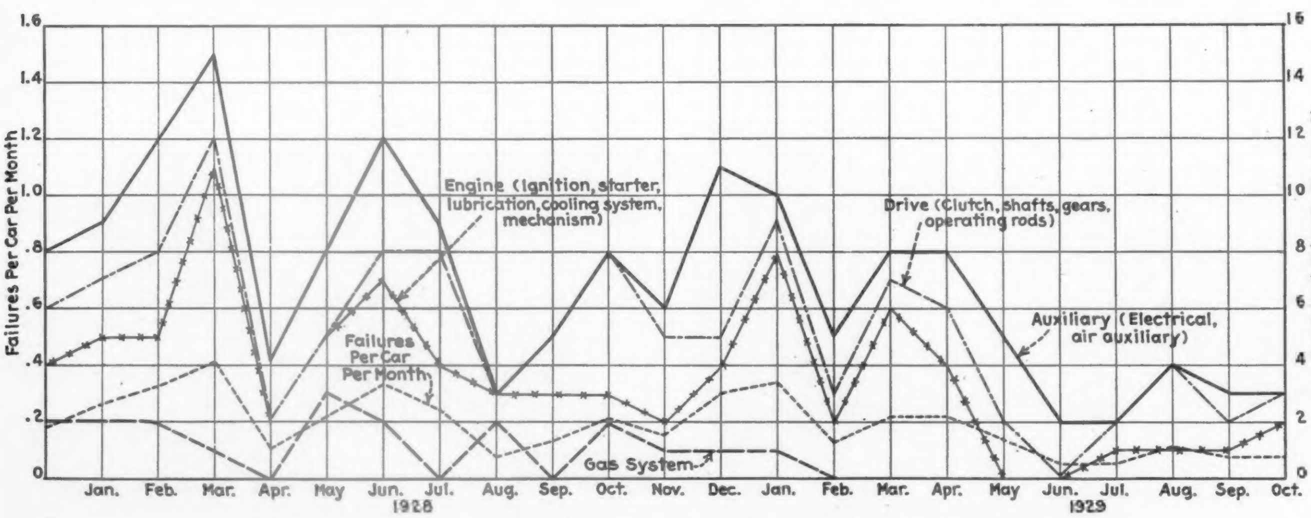
Form 5084-A, is the inspector's weekly report. One is returned at the end of the week for every car under his jurisdiction, to the supervisor of rail-car maintenance and inspection. The inspector visits each terminal under his jurisdiction once a week. He makes a report to the maintainer at that point on all car defects found.



All engines going out of the shop are given a dynamometer test before being applied to the car

This report is checked on his next visit the week following.

Form 1057-G-1 is a record of the lubricating and fuel-oil consumption for the month. This report shows the amount and kind of gasoline used by different units and also the amount of grease, oil and transmission lubricant. These reports are signed by the master mechanic, and are sent to the supervisor at the end of each month. Reports are also made on the condition of batteries and each maintainer keeps a record of the specific gravity reading of each battery cell. This report is also forwarded to the supervisor at the end of each month. Each inspector takes hydrometer readings on his weekly visits of inspection. The maintainers' and fuel-lubrication report cards are kept in a sheet-metal case which is attached to the wall of



Record of failures chargeable to different mechanisms duri ng 1928 and 1929

the engine room in each motor car. Thus, these records can be referred to by the supervisor or inspector at any time, enabling them to ascertain readily whether or not maintenance work is being performed as prescribed.

Heavy repair work is being handled in a main shop at New Haven, Conn. This shop is equipped solely for the handling of heavy repairs to rail motor cars. It is well provided with the special tools for fitting main and rod bearings accurately, and with an engine dynamometer, water rheostat, electrical instrument and auxiliary testing apparatus, special fuel-system testing benches, etc. All work passing through the New Haven shop must be approved by a resident inspector who makes his report on Form 5084-C.

Tools and Fixtures for Repair Work

A number of interesting kinks are shown in several of the illustrations, such as the shop truck on which engines are repaired and moved around the shop. The construction of this truck permits rotating the engine to any position convenient for the mechanic. A number of tools used in repairing engines are shown in the interior view of the repair shop. The cam-shaft reamer shown laying across the two horses in the foreground, is one of the tools developed at New Haven. A boring bar is shown inserted through the crank-shaft-bearing seats of the engine in the foreground. This bar is fitted with fly-cutters and is turned with the hand wheel, which fits on the end of the bar. Whiting hoists are used for the removal and application of trucks, and to facilitate the performance of work underneath the car.

The development of a large number of tools and fixtures was found to be necessary when the larger units required their first general overhaul. Practically nothing in the line of suitable equipment for making repairs to engines, especially to engines of 250 hp., could be purchased. It was necessary for the mechanical-engineering department and the shop forces to cooperate in the development of suitable boring bars, special reamers and fixtures, in addition to special testing apparatus for testing vacuum tanks, oil pumps, vacuum pumps, tachometers, carburetors, etc.

The Unit-Replacement Program Feature of Rail Motor Car Maintenance

Regular scheduling of rail-motor cars for heavy repairs is made as much as possible to conform with what is termed the "unit replacement program." Complete spare assemblies such as engines, generators, traction motors, transmissions, trucks, etc., are kept on hand ready for application as soon as the car comes into the shop. Each car, on arrival at the New Haven shop, is stripped of its various unit assemblies, and the replacement units are applied. The units removed are placed in condition for service, and are applied to another car of the same class going through the shop at a later date. Sufficient spare engine and truck units have been acquired for the gas-electric cars to reduce the shopping time for this type of equipment by one-half. As a general rule, steam equipment is used to replace a gas-electric rail motor car when it is out of service. Motor-car operation has been adopted, in practically all instances, because of the economy of operation as compared to that of steam. Therefore reducing the time a car is in the shop increases the time in service and secures greater economy through the increased availability. The money spent for spare unit assemblies has proved to be economical.

The shop foreman at New Haven schedules the work

THE NEW YORK, NEW HAVEN AND HARTFORD RAILROAD COMPANY

Gas Rail Car Inspection Record — Gas Rail Cars No. 9000-02 / 9004-23 Incl.

Month ______ Maintained at ______ Car No. ______

Miles During Month ______ No. of Failures ______ Total Detention — Hours ______ Minutes ______

Total Mileage to Date ______

	ITEM	DATE AND INITIALS		ITEM	DATE AND INITIALS
	MONTHLY				
1.	Magneto and Generator—oil and check		8.	Magnetic Switch—check	
2.	Magneto Points—check		9.	Transmission—check	
3.	Distributor Points—check		10.	Transfer Case (Sykes)—check	
4.	Starting Motor and Bendix Gears—check		11.	Bolster Shafts (Brill)—check for lateral	
5.	Jam Nut End of Crankshaft—check		12.	Axle Reverse Adjustment (Brill) check	
6.	Valve Stem Clearance—check		13.	Compressor—oil	
7.	Cylinder Compression—check		14.	Miscellaneous—check	
	SEMI-MONTHLY				
1.	Crank Case—drain and fill; clean strainer (winter)		5.	Sanders—check and clean	
2.	Gas Lines and Fittings—blow and check		6.	Strombos Horn—check adjustment	
3.	Tachometer Gears—grease		7.	Battery Charging—Rate—check	
4.	Journal Boxes—grease		8.	Miscellaneous—check	
	WEEKLY				
1.	Water Hose and Connections—check		8.	Transfer Case (Sykes)—fill	
2.	Water Pump—grease and check packing		9.	Reverse Gear Case—(Mack)—fill	
3.	Distributor Shaft (Mack)—oil		10.	Axle Gear Drive Boxes—fill	
4.	Radiator Shutters—check		11.	Gear Shift Mechanism—check	
5	Spark Plugs—check		12.	Poppets (Brill)—check	
6.	Clutch (Sykes)—flush and refill		13.	Air Compressor Drive—check	
7.	Transmission—fill		14.	Bolster Hangers—Brake Pins—Journal Plates—oil	

	ITEM	DATE AND INITIALS		ITEM	DATE AND INITIALS
	WEEKLY (Con'd)				
15.	Bolts and Connections—check		20.	Batteries—check and refill	
16.	Electrical Leads and Connections—check		21.	Miscellaneous—check	
17.	Wheels and Axles—check		19	Gauges and Instruments—check	
18.	Heater Motor and Fuses—check				
	DAILY				
1.	Water Level—check		11.	Clutch Collar—grease	
2.	Alcohol in Radiator—check		12.	Fan Shaft (Mack)—oil	
3.	Gas Tanks—fill		13.	Universal Joints—grease	
4.	Crank Case Oil Level—check		14.	Side Bearings—grease	
5.	Oil Leaks—check for		15.	Miscellaneous Cups and Fittings—grease	
6.	Oil Pressure—check		16.	Thermoid and Universal Joints—check	
7.	Signal Bell—check		17.	Gas Strainers and Vacuum Lines—check	
8.	Battery and Magneto Ignition—check		18.	Air-Brake System—check to I. C. C. Requirements	
9.	Engine Controls—check		19.	Miscellaneous—check	
10.	Clutch Adjustment—check				

NOTE.—(Brief Description of Failures During Month, with Dates.)

APPROVED: ______ MASTER MECHANIC.

Front and reverse sides of inspection record

through the shop to conform with the situation as shown on the shop schedule board. This board, which is shown in one of the illustrations, shows the status of unit replacement parts going through the shop, the promised date for cars to go out of the shop, the status of materials required and on order, and the distribution of work to the shop force. Any delays to the scheduled progress of a car, or to a unit assembly, going through the shop on account of failure to receive the material or a failure on the part of the shop forces, is shown on the board. This system permits efficient control and supervision over shop production at all times.

The experience of the New Haven has shown the wisdom and economy of providing the best of back-shop facilities. Putting work through the shop entails considerable work on the part of those in charge to meet the requirements of accuracy and thoroughness necessary in repairs to rail motor cars. It is difficult to persuade a man to do good work without proper environment and incentives. Although this applies to any kind of shop work, it is especially applicable to the maintenance of rail motor cars. Cleanliness, warmth, good light, and crane and pit facilities are essential.

Present Methods Based on Eight Years' Experience

The present methods of maintenance, inspection and supervision have been developed from the accumulated experience of the past eight years. The assigning of the maintenance of a number of cars at outlying points to one master mechanic, has proved advantageous. One inspector can inspect during the week all the cars coming under the supervision of one master mechanic. There are a few outlying points where cars are assigned the location of which makes it impracticable to make a group assignment. In such cases it has been found economical to assign a mechanic to this outlying point to make the daily inspections and necessary running repairs. An inspector, of course, visits this point once each week. The time required going to and from the outlying point was considerable, and frequently little time was left for actual maintenance work, unless the mechanic was allowed to work overtime. Locating a mechanic at an outlying point which is difficult to reach from a major repair terminal has saved considerable in labor expense. Rail motor cars coming into large terminals present little difficulty from a maintenance standpoint and are assigned certain hours by the regularly qualified maintainer as part of his routine work.

Records and Charts

Working arrangements such as those described in the preceeding paragraph, are largely the result of the study of carefully compiled statistics and records. Charts and records pertaining to the various phases of rail motor car operation and maintenance are kept in a multiplex revolving holder in the office of the supervisor. This type of holder makes for easy reference, and the records contained therein are referred to constantly. These records cover shopping periods, car-miles per failure, per cent serviceable days, failures per month, car-shop days, maintenance costs, labor and material, etc. This information is shown separately for the Lines East and the Lines West.

Two of these charts are illustrated. It will be noted that since 1924 there has been a considerable decrease in the number of failures per car per month and the number of days in the shop. An interesting point in connection with the chart showing the failures chargeable to different unit mechanisms, is that failures due

Form 5004-A

THE NEW YORK, NEW HAVEN AND HARTFORD RAILROAD COMPANY

GAS RAIL CAR INSPECTION RECORD ______ GAS RAIL CARS No. 9000-2 / 9004-23 INCL.

Name of Inspector ______ Car Number ______

Running Inspection Between ______ and ______ Dates ______

Stationary Inspection at ______ Dates ______

Terminal Inspection at ______ Dates ______

Report for Week Ending ______

	Item	Written Up	Condition		Item	Written Up	Condition
1.	Water Level			25.	Poppets (Brill)		
2.	Alcohol in Radiator			26.	Compressor Drive		
3.	Crankcase Oil Level			27.	Bolster Hangers, Brake Pins, Journal Plates		
4.	Oil Leaks			28.	Bolts and Connections		
5.	Oil Pressure			29.	Electrical Leads and Connections		
6.	Signal Bell			30.	Wheels and Axles		
7.	Battery and Magneto Ignition			31.	Heater Motor and Fuses		
8.	Engine Controls			32.	Gauges and Instruments		
9.	Universal Joints			33.	Batteries and Charging Rate		
10.	Miscellaneous Caps and Fittings			34.	Journal Boxes		
11.	Thermoid and Universal Joints			35.	Sanders		
12.	Gas Strainers and Vac. System			36.	Strombos Horns		
13.	Air-Brake System, including Governor and Piston Travel			37.	Magneto		
14.	Gas Lines and Fittings			38.	Generator		
15.	Water Hose and Connections			39.	Distributor		
16.	Water Pump			40.	Starting Motor and Bendix Gears		
17.	Radiator Shutters			41.	Jam Nut End of Crank Shaft		
18.	Spark Plugs			42.	Valve Stem Clearance		
19.	Clutch and Adjustment			43.	Cylinder Compression		
20.	Transmission			44.	Magnetic Switch		
21.	Transfer Case (Sykes)			45.	Bolster Shaft-lateral (Brill)		
22.	Reverse Gear Case (Mack)			46.	Axle Reverse Adjustment		
23.	Axle Gear Drive Boxes			47.	Sound of Engine		
24.	Gear Shift Mechanism			48.	Color of Exhaust		

(Over)

	Item	Written Up	Condition		Item	Written Up	Condition
49.	Hits on All Cylinders			54.	Cleanliness of Engine		
50.	Full Power Obtained			55.	Cleanliness Inside Car		
51.	Carburetor Operation			56.	Cleanliness Outside Car		
52.	Engine Speed Observed: (a) Loaded (Max.)		R.P.M.	57.	Efficiency Rating of Car		Per Cent
	(b) Light (Max.)		R.P.M.	58.	Efficiency Rating of Operator		Per Cent
	(c) Idling		R.P.M.				Name
53.	Gear Shift Operation			59.	Miscellaneous		

TERMINAL CONDITIONS

	Item	Written Up	Condition		Item	Written Up	Condition
60.	Rectifier			65.	Lubricants—Are correct grades used?		
61.	Gasoline Tank and Pump			66.	Heating of Terminal		
62.	Gasoline Hose and Strainers			67.	Efficiency of Heater		Per Cent
63.	Maintenance Work: (a) Lubrication			68.	General Efficiency Rating of Terminal		Per Cent
	(b) Other Work			69.	Miscellaneous		
64.	Material and Tool Supplies: (a) Lubricants						
	(b) Other Items						

REPORT ON FAILURES SINCE LAST INSPECTION:

GENERAL REMARKS:

(Sign) ______ MECHANICAL INSPECTOR

Front and reverse sides of the inspector's weekly report

to the gas system disappeared entirely in February, 1929. Auxiliary gas feed systems were installed on all cars at that time.

At the present time the serviceability of all cars is over 90 per cent. A recent check of the records shows that the Lines West operated 14 cars—five gas-electric and nine mechanical drive—for three consecutive months without a single road delay of five minutes or over. An improvement of 36 per cent was made for the first half of 1929 over the year 1928 in the reduction of road delays. Twenty-three cars equipped with the mechanical drive operated 31,349 miles without a delay. If this may be considered good performance, it is the result of the carefully built-up program of maintenance and inspection.

Form 6884-C

THE NEW YORK, NEW HAVEN AND HARTFORD RAILROAD COMPANY
GAS RAIL CAR GENERAL OVERHAUL
INSPECTOR'S MEMORANDUM

CAR No. .... RECEIVED FROM ....
DELIVERED TO ....
DATE IN .... DATE OUT ....

NOTE: In cases where workmanship or parts are defective, report shall be made to Foreman in charge, on Form No. 1107-Q, at once.

No.	Item	Date	Written Up	O. K.	No.	Item	Date	Written Up	O. K.
	ENGINE - No.					COOLING SYSTEM			
1	Housings				38	Radiator			
2	Crankshaft				39	Water pump			
3	Main bearings				40	Fan			
4	Rod bearings				41	Hose piping and connections			
5	Wrist pins				42	Radiator shutters			
6	Pistons				43	Miscellaneous			
7	Piston rings								
8	Cylinder sleeves					FUEL SYSTEM			
9	Accessory drive				44	Carburetor and Control Rods			
10	Valves				45	Vacuum tank and System			
11	Valves seats and guides				46	Oil vacuum pump			
12	Valve springs				47	Gas tanks and gauges			
13	Valve mechanism				48	Fuel lines			
14	Cylinder heads				49	Strainers			
15	Camshafts				50	Autopulses			
16	Camshaft bearings				51	Miscellaneous			
17	Valve timing								
18	Magneto timing					CLUTCH			
19	Battery timing				52	Housings			
20	Flywheel and Ring Gear				53	Springs			
21	Bendix drive				54	Discs			
22	Spark plugs				55	Bearings			
23	Bolts, cotter pins and				56	Brake			
	securing connections				57	Release mechanism			
24	Dynamometer test				58	Shaft			
25	Miscellaneous				59	Miscellaneous			
	OIL LINES & LUBRICATION SYSTEM					TRANSFER CASE			
26	Oil pump				60	Gears			
27	Camshaft oil lines				61	Jaw clutches			
28	Crankshaft oil lines				62	Bearings			
29	Oil pump suction line				63	Housings			
30	Drain from cylinder heads				64	Shafts			
31	Main oil line				65	Operating mechanism & adjustment			
32	Oil pressure relief valve				66	Miscellaneous			
33	Oil pressure gauge								
34	Level indicator					COTTA TRANSMISSION			
35	Strainers				67	Gears			
36	Fittings and connections				68	Bearings			
37	Miscellaneous				69	Shafts			

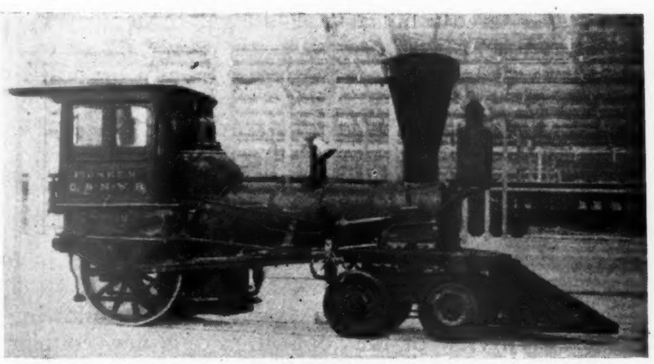
No.	Item	Date	Written Up	O. K.	No.	Item	Date	Written Up	O. K.
	COTTA TRANSMISSION (Cont.)					ELECTRICAL EQUIPMENT (Cont.)			
70	Housings				106	Magnetic switch			
71	Jaw clutches				107	Ignition switch & starting button			
72	Operating mechanism & adjustment				108	Regulators			
73	Miscellaneous				109	Ammeter			
					110	Fuse box			
	BRILL No. 65 BOLSTER				111	Switch panel			
74	Gears				112	Spark retard switch			
75	Jaw clutches				113	Fuses			
76	Bearings				114	Resistance units			
77	Housings				115	Wiring			
78	Shafts				116	Lighting			
79	Shifting rails				117	Heating motor			
80	Spacers				118	Miscellaneous			
81	Poppets					MISCELLANEOUS			
82	Interlocks				119	Air compressors & governors			
83	Operating mechanism & adjustment				120	Air brake equipment			
84	Miscellaneous				121	Gauges & Instruments			
					122	Window wipers			
	AXLE DRIVE				123	Streamline horn			
85	Gears				124	Sanders			
86	Jaw clutches				125	Bells			
87	Bearings				126	Stoves			
88	Housings				127	Emergency tools			
89	Shafts				128	Car service tools			
90	Operating mechanism & adjustment				129	Odometers			
91	Miscellaneous					BODY			
					130	Doors			
	DRIVE SHAFTS & JOINTS				131	Upholstery			
92	Universal & thermoid joints				132	Seats			
93	Couplings and flanges				133	Cushions			
94	Drive shafts				134	Windows and curtains			
95	Line bearings				135	Bodywork & framework			
96	Trucks				136	Paint			
97	Wheels				137	Racks			
98	Axles				138	Miscellaneous			
99	Brake rigging					RUNNING TEST			
100	Miscellaneous				139	Power			
					140	Oil leaks and pressure			
	ELECTRICAL EQUIPMENT				141	Gear shifting			
101	Batteries				142	Clutch action			
102	Starting motor				143	Controls			
103	Generator				144	Stiffness			
104	Magneto				145	Vibration			
105	Distributor				146	Miscellaneous			

GENERAL REMARKS:

Signed: ____________
Gas Rail Car Inspector

Front and reverse sides of the general overhaul report

* * *



From collection of W. A. Lucas

Chicago & North Western "Pioneer" built by Baldwin in 1836—The locomotive is shown as it was rebuilt for exhibition at the Chicago World's Fair in 1893

Decisions of Arbitration Cases

(The Arbitration Committee of the A. R. A. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.)

Dining Car Damaged by Fire—Ex Parte Case

On December 9, 1927, the Southern Pacific dining car, 10018, was badly damaged and considerable equipment and supplies were lost in a fire which started in the pantry and kitchen of the car. The car was returned to the owner's shops at Sacramento, Cal., for repairs. The Chicago & North Western disclaimed any responsibility for the damage, and refused to accept a bill from the Southern Pacific Company, Pacific Lines, for the cost of repairs and the value of the equipment and supplies lost in the fire. This car was being used in joint passenger-train operation between Chicago and points on the Pacific coast. According to the statement of the Southern Pacific, dining cars used in this service are locked by a special lock, for which only Southern Pacific and Union Pacific representatives have keys. Chicago & North Western employees are not furnished with keys. In cases where it is necessary for a Chicago & North Western employee to make repairs, the pantry

and kitchen compartments, are unlocked by a local representative of the car owner.

The Arbitration Committee rendered the following decision—"Under the A.R.A. Interchange Rules, in the absence of a definite agreement to the contrary, the Chicago & North Western is responsible for the fire damage to the car which occurred while the car was in its possession."—*Case No. 1611—Ex Parte Case of Southern Pacific Company.*

Scrapping of Mate Wheels

On May 12, 1928, at Council Bluffs, Ia., the Union Pacific removed a pair of 36-in. rolled-steel wheels from Southern Pacific mail car, 4087, on account of one wheel having a worn tread and the mate wheel a worn flange. Both wheels had ½ in. service metal before turning. After turning, there was ⅛ in. service metal remaining on the wheel which had the worn tread, while the one with the worn flange could not be turned to contour. The Union Pacific scrapped both wheels. The Southern Pacific Company, Pacific Lines, contended that this was in error and that proper credit should have been allowed for ⅛-in. service metal on the one wheel. According to the Southern Pacific, this case involved interpretation of Rules 71 to 81, inclusive, which define wheel defects and it contended that the word "defective" was not used in Rule 98 as referring to a defect due to any cause other than wear. The Union Pacific claimed that the words in section g, Rule 98, "necessarily scrapped before it reaches the limit of wear" qualified the word "defective."

The following decision was rendered by the Arbitration Committee—"Inasmuch as one of the wheels had reached the limit of wear beyond turning for further service, the scrapping of the mate wheel was justified. The contention of the Union Pacific is sustained."—*Case No. 1612—Southern Pacific vs. Union Pacific.*

Repair Cards of Other Roads Are Not Sufficient to Prove Cars Were Incorrectly Light-Weighed

Chicago & Alton car 38923, was light-weighed by the Atlanta, Birmingham & Coast on February 23, 1927, on account of the light weight stenciling being out of date. The old weight was 46,100 lb. and the new weight stenciled on the car was 46,600 lb. The car was again weighed by the Atchison, Topeka & Santa Fe on June 12, 1927 and the light weight of 46,600 lb. was changed to read as being 46,100 lb. Another Chicago & Alton car No. 38127, was light-weighed by the Atlanta, Birmingham & Coast on May 10, 1927. The old weight of 46,700 lb. being changed to the light weight of 46,200 lb. This car was again weighed by the St. Louis-Southwestern on November 11, 1927, showing the old weight as being 46,200 lb. and the new weight as 45,900 lb. The Chicago & Alton submitted repair cards of the Atchison, Topeka & Santa Fe, and also of the St. Louis-Southwestern as joint evidence cards according to Rule 90, and requested cancellation of the Atlanta, Birmingham & Coast charges, claiming that the cars had received nothing but running repairs, and it was evident that the weights shown by the A. B. & C. were in error due to some violation of Rule 30, or its scales were not functioning properly. The latter claimed that the cars were weighed in accordance with Rule 30, which permits bills to be rendered where the weight varies 300 lb. or more, and that the repair cards of the St. Louis-Southwestern or the Atchison, Topeka & Santa Fe did not establish the claim of the owners that the cars had been incorrectly light-weighed. It stated that it was a member of the Southern Weighing and Inspection Bureau, and that its scales were tested and inspected periodically by this bureau.

The Arbitration Committee rendered the following decision—"The position of the Chicago & Alton is not sustained. On the basis of Rules 30 and 31, there is not sufficient evidence that either of these cars were incorrectly re-weighed or re-marked by the Atlanta, Birmingham & Coast."—*Case No. 1615—Chicago & Alton vs. Atlanta, Birmingham & Coast.*

Air Hose Burst Causing Derailment—Application of Rule 32

On December 30, 1927, two cars of a Boston & Maine freight train were derailed and buckled together near Greylock, Mass. This train consisted of 44 loads and 22 empties, a total of 2,535 tons. An air hose burst on Quebec Central car No. 2422 while the train was passing Blackinton station, near Greylock, at a speed of 20 m.p.h. This car was the thirteenth car from the rear end of the train. The application of the brakes pulled out the draw bar on one end of Boston & Maine car No. 63478, the draft timbers of which were in a defective condition. This car was the fifth car in the train from the locomotive. The sudden stop of the train caused two empty Quebec Central cars Nos. 1525 and 1909, which were of wooden construction, to buckle. All of the sills of both cars were broken. The Boston & Maine claimed that the failure of the Q. C. cars was due to their weak construction and age. The Quebec Central maintained that the direct cause of the damage was the pulling out of the draw bar on the Boston & Maine car and not the bursting of the air hose.

The Arbitration Committee, in rendering its decision stated that "Investigation developed that the cars were not damaged under any of the conditions of Rule 32. Car owner is responsible."—*Case No. 1613—Boston & Maine vs. Quebec Central.*

Complete Coupler Applied Because of Defective Riveted Yoke

In February 15, 1928, N.A.T.X. car 959, was repaired by the Chicago, Rock Island & Pacific at Clinton, Okla. One new A.R.A. Type D, 5-in. by 7-in. coupler was applied on account of the coupler yoke being broken. The coupler which was removed from the car was also an A.R.A. Type D coupler and was in good condition. The railroad rendered a bill against the car owner covering the difference in value between the new and second-hand couplers. The North American Car Corporation objected to this charge, claiming that the second-hand coupler removed should have been replaced by another second-hand coupler and no bill rendered. The Rock Island claimed the charge to be correct in accordance with Arbitration case No. 1551. It contended that Rule 104 authorized the charge made, whether or not facilities were available at the repair point to rivet a new yoke on the coupler.

The Arbitration Committee rendered the following decision—"In view of the application of a new coupler complete on acocunt of a defective riveted yoke (owners responsibility), the charge of the Chicago Rock Island & Pacific is sustained."—*Case No. 1614—North American Car Corporation vs. Chicago Rock Island & Pacific.*

Alloy Steels for Railroad Service

Metallurgists and mechanical engineers discuss the use of alloy steels at annual meeting of the A.S.M.E.

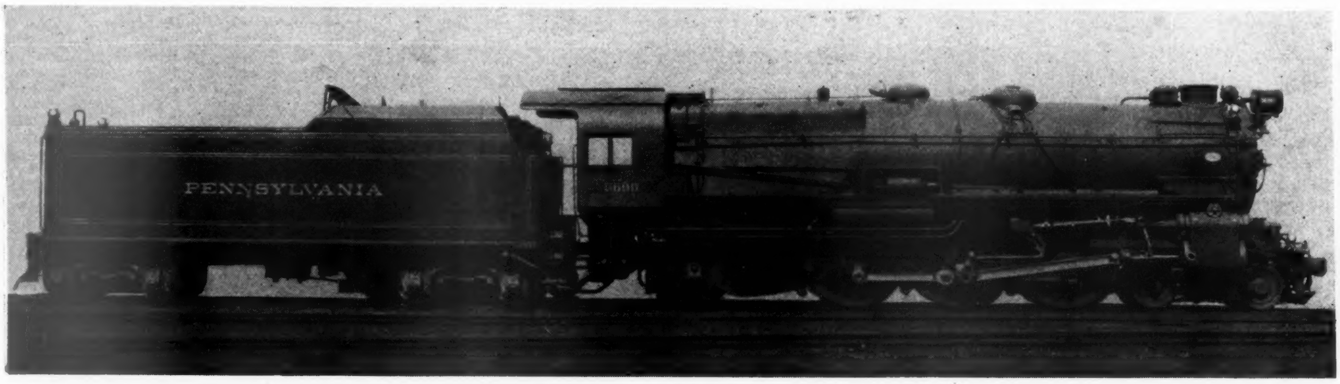
A MOST informative session on steels was held by the Railroad Division of the American Society of Mechanical Engineers on the afternoon of December 5, 1929, during the annual meeting of that society. The paper discussed was entitled, Alloy Steels in the Railroad Field, which was presented by Charles McKnight, metallurgist for the International Nickel Company, New York.

A considerable part of the discussion was devoted to the relative merits of carbon and alloy steels, especially as used in locomotive construction. Problems pertaining to handling alloy steels in the average railroad blacksmith shop, and also in welding fractures were discussed by those present. It was evident that both the manufacturers and users were in agreement that the application of alloy steels to locomotives begins where carbon steels cease to render satisfactory service.

Following is an abstract of Mr. McKnight's paper together with a summary report of the discussion.

Some confusion has occurred because steels are being and made better than a similar straight-carbon steel. Otherwise a large part of the advantage gained by the alloy addition is lost. It is probable that, were it possible to remove the alloy from steel after manufacture, the alloy steel would still be superior to ordinary steel, simply on account of the additional precautions taken.

This quality is one reason for the additional cost of alloy steels. If the price per pound of alloy steel is analyzed, it will be found that the alloy addition alone is not sufficient to account for the excess cost. For example, 3.5 per cent nickel steel is currently quoted in bar form at 4.15 cents per pound, while carbon-steel bars are a little under 2 cents per pound. The nickel addition alone, even at 35 cents per pound for nickel, accounts for not quite 1.25 cents. Therefore, almost one cent, or little less than the cost of the alloy, goes for the "quality factor." Although this may seem out of all proportion, it is not unfair for the steel manufacturers to make such a charge, providing the steel is really of good quality.



Pennsylvania 4-6-2 type locomotive equipped with nickel-steel boiler

sold today under names indicating that they are alloy steels when, as a matter of fact, the content of "alloying element" is slightly above that normal to all steels. An example of this is the so-called "silicon steel" which is used for ship plate and structural shapes. The silicon is actually only a few hundredths of one per cent higher than usual and the term is a misnomer. Such steel could better be called "killed steel" than "silicon steel." On the other hand, the two elements common to all steels, manganese and silicon have valuable alloying properties, and recently these properties have been taken advantage of to produce a cheap and satisfactory steel.

An alloy steel may be defined in a general way as a steel containing an appreciable percentage of one or more elements (other than iron and carbon) conferring special virtues on the metal. This definition, however, does not tell the whole story. To be worthy of the name, alloy steel must necessarily be of a better quality

The designing engineer finds at his hand three types of steel:

Carbon Steels.—These steels are used for the vast majority of purposes for very good and economical reasons. There is a tendency, in the view of recent metallurgical developments, rather to belittle carbon steel, but it should be remembered that conscientiously made carbon steel will in most places give more per dollar than any other structural material. The field of locomotion by land, water and air furnishes an outstanding exception to this generalization.

Alloy Steels.—Alloy steels are essentially special steels for special purposes. The growth in their use has been and will be rapid, but it is a mistake to use an alloy steel where its use is not justified.

Semi-Alloy Steels.—This term is really a misnomer as there should be a sharp distinction between alloy steels and carbon steels. At the present time, however, there are steels on the market which have had relatively

small extra additions of metalloids ordinarily used in making steel. They are slightly more expensive than carbon steels with slightly better properties. They are a compromise between the two other grades, and it remains to be seen whether they can justify themselves economically.

Forgings of Alloy Steel

The locomotive designer in recent years has adopted alloy steel for forgings more generally because of the larger power units, and because the size of forgings cannot be increased indefinitely. Strictly speaking, it is not a new development. In the early days of alloy steel, the railroads were among the first users, but alloy steels got quite an unsavory reputation with them. The reason for this was that it was not then appreciated that mass makes a great difference in the properties of forgings, and that the heat treatment must conform to the size of the piece. It is manifestly ridiculous to compare the 1¼-in. rear-axle shaft of an automobile with a 10-in. or 12-in. locomotive driving axle, and yet, in the early days the same steel and the same heat-treatment were used for both with disastrous results in the case of the driving axle.

Fifteen or so years ago, after a temporary lapse, alloy steels again began to be used with intelligently written chemical specifications, and intelligently conceived and controlled heat treatments. While quite a number of alloy-steel forgings are still heat treated by quenching temperature. This is in order to free the metal from stresses set up by cooling, and to put it in the best condition for service from a metallurgical standpoint. The drawing temperature must, of course, be lower than the critical point. It is usually about 1,100 to 1,200 deg. F. and the forgings are again kept at that temperature for one hour or more for each inch of cross-section, after which they are cooled either in the air or furnace. It does not matter greatly which cooling method is used, but probably the air cooling is preferable.

Good heat treatment of alloy-steel forgings is an essential, but again quality is a great factor. No alloy ever made bad steel good. It is necessary, as a metallurgist has aptly said, to begin the manufacture of alloy steel with its pre-natal care, and, as a railroad man even more aptly said, to choose your steel-maker as you would your physician. Quality brings in so many details, such as method of manufacture, rolling vs. pressing, etch-tests, etc., that they can hardly be hinted at, much less discussed in a paper of this length.

The majority of alloy-steel forgings now made conform to one of the following types:

1—Carbon-vanadium steel, normalized and tempered.
2—Nickel steel, normalized and tempered.
3—Chrome-vanadium steel, quenched and tempered.
4—Nickel-chromium steel, quenched and tempered.

The first two air-treated types probably account for more than 75 per cent of all alloy-steel locomotive forgings, as the latter two are not widely used.

Average of 523 Tests on 3.0 Per Cent Nickel-Steel Boiler Plate

	Average per cent	Specified per cent		Average	Specified
Carbon	0.163	0.20 Max.	Ultimate tensile strength	77,880 lb.	70,000 lb. min.
Manganese	0.557	0.40–0.80	Yield point	47,550 lb.	50 per cent U. T. S.
Phosphorus	0.021	0.045 Max.	Elongation in 8 in.	36.33 per cent	1,600,000 U. T. S.
Sulphur	0.029	0.045 Max.			Min. 20 per cent
Silicon	0.203	Not Spec.	Reduction of area	54.15 per cent	50 per cent
Nickel	2.960	2.75–3.25	Impact value, Izod	63.4 ft.-lb.	

in some liquid medium such as oil or water, it is generally conceded that such drastic treatment, while producing higher strength, is not conducive to the greatest reliability. Strength is, therefore, sacrificed to a slight extent, the cooling medium is air instead of a liquid, and the large forgings of today are much freer from strains and cracks.

The heat treatment in general use today for large railroad forgings is specified by the term "normalize and draw" or "normalize and temper." In this process the metal after forging but before machining is slowly heated to a predetermined temperature, and is held at that temperature one hour or more for each inch of cross-section. The predetermined temperature is one higher than the so-called "critical point" of the metal, at which the various constituents of the steel merge into an amorphous solid solution. This critical point varies with the carbon and alloy content of the steel. The higher the carbon, the lower the critical point. The alloy having the most marked effect is nickel, which has a tendency to lower it. In the absence of accurate data, 1,600 deg. F. is taken generally as a safe temperature for normalizing. Higher temperatures than this induce excess grain size, and lower ones are not safely above the critical point.

After the steel has remained at this temperature the required time, it is removed from the furnace and is allowed to cool in still air, free from drafts and not exposed to rain, snow, or other chilling agency. When it has cooled so it is no longer red, it is replaced in the furnace and heated to the "drawing" or "tempering"

As representative of what may be obtained from an alloy-steel forging of large size normalized and tempered, carbon-vanadium steel analyzing:

Carbon	0.40–0.50 per cent
Manganese	0.75–0.90 per cent
Vanadium	not less than 0.18 per cent

will give on the average tensile values of:

Ultimate tensile strength	90–100,000 lb.
Yield point	60– 70,000 lb.
Elongation in 2 in.	22–28 per cent
Reduction of area	40–45 per cent

For comparison, carbon steel with about the same carbon (0.45-0.50) will give:

Ultimate tensile strength	75–85,000 lb.
Yield point	40–50,000 lb.
Elongation in 2 in.	18–25 per cent
Reduction of area	35–42 per cent

In the opinion of the author, these are about the maximum results which can be obtained from a normalized steel, no matter what alloy or combination of alloys is used. Yet there is still an uncomfortably large number of failures. In the past there were failures with wrought iron, so steel was adopted; there were failures with steel, so alloy was adopted. Perhaps our reasoning has been wrong, and strength is not the absolute criterion of a good locomotive forging. During the past six years, there has come into prominence and popularity a steel which deliberately sacrifices a little strength to obtain a lot more toughness and shock resistance. The carbon content is much lower than is usual, and nickel is the supporting alloy. Such a steel,

normalized and tempered has, in large locomotive forgings, given an average of:

Ultimate tensile strength	83,535 lb.
Yield point	60,371 lb.
Elongation in 2 in.	31 per cent
Reduction of area	60 per cent
Carbon 0.24 per cent; nickel	2.58 per cent

Impact tests are illuminating. Izod impact values on this steel, made on test pieces from large forgings, run 50, 60, 70 ft.-lb., and even higher. This indicates more than double the shock-resisting capacity of the usual higher-carbon alloy steel. Such a steel merits attention.

Alloys Used in Castings

The alloys, alone or in combination, most employed in railroad work for steel castings are, vanadium with content not less than 0.18 per cent, manganese 1.00 to 2.00 per cent and nickel 1.50 to 3.00 per cent. With a carbon content of from 0.30 to 0.40 per cent, these alloy steels give minimum physical characteristics of:

Ultimate tensile strength	80,000 lb.
Yield point	45,000 lb.
Elongation in 2 in.	25 per cent
Reduction of area	45 per cent

Such figures are obtained on large castings, such as frames, after a heat treatment consisting of normalizing and tempering. This treatment is essentially the same as that detailed for forgings. However, due to the difference in the structure of castings as compared with that of rolled or forged steel, it is quite usual to employ a preliminary heat treatment known as a homogenizing treatment. This is carried out at a higher temperature (1,600-2,000 deg. F.), and the castings are air-cooled. By it the original casting structure is more completely broken up. Smaller castings will have somewhat higher properties, and for such castings it is often permissible to use the "quench-and-temper" treatment to obtain even better results, provided the section is not too intricate. In this field, too, interesting results have been obtained by departing from the conventional, and using a low-carbon alloy steel.

A valuable application of alloy steels for castings was brought out by the chief mechanical engineer of a large railroad. He could obtain low-carbon alloy steel castings at approximately 35 per cent increase in price over ordinary steel castings. He therefore designed some new power to use alloy-steel castings, cutting down the section on all castings to one-third of the former size, but maintaining a minimum section of ¼ in. By these means, the net cost of the castings per locomotive was the same, but the total weight of castings was one-third the previous figure, and the strength was slightly higher. The saving in weight per locomotive was on the order of 10,000 lb., which could be applied to power-producing purposes.

The only two steels used in any quantity for high-pressure boilers, have been manganese from 1.00 to 2.00 per cent, and nickel, 1.75 to 3.25 per cent. The vast majority of alloy-steel boilers, in fact practically all, have been made from nickel steel for two reasons. First, boiler plate is per se a low-carbon material, and nickel, not being dependent for its alloying qualities on carbon, confers higher properties than any other alloy. Second, while it is possible to obtain as high or higher strength with other alloys, nickel steel develops to a very high degree, resistance to embrittlement and ageing, and has unusually satisfactory strength at boiler temperatures, a necessity often neglected.

The tensile results obtained with a 3.0 per cent nickel-steel boiler plate, together with those of carbon-steel plate for comparison, are shown in the tables.

Average of 385 Tests on Carbon Steel Boiler Plate

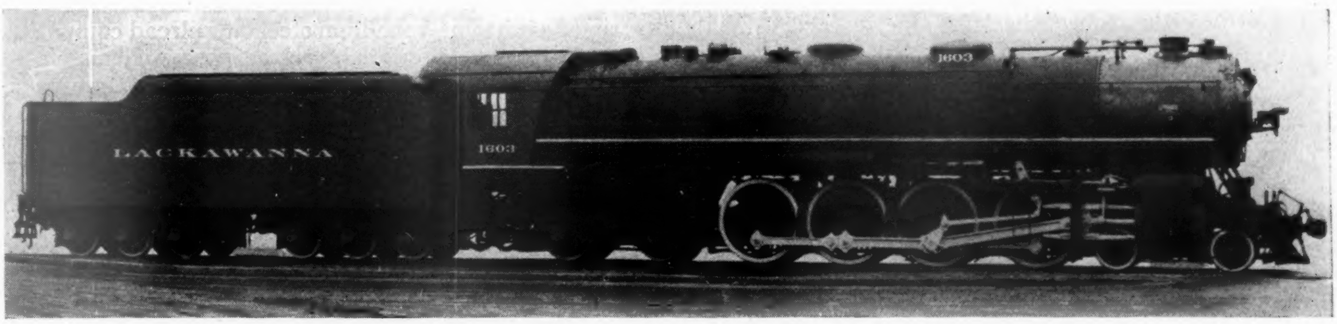
	Average per cent		Average
Carbon	0.193	Ultimate tensile strength	59,200 lb.
Manganese	0.041	Yield point	36,200 lb.
Phosphorus	0.022	Elongation in 8 in.	28.64 per cent
Sulphur	0.033	Reduction of area	(Not determined)
		Impact, Izod	(Not determined)

The mechanical engineer may ask what will happen if even higher pressures are required in the conventional fire-tube boilers. The answer is that nickel-steel boiler plate can be manufactured with a tensile strength of 100,000 lb. or more, but it is not desirable to do so at present.

Corrosion Reduction

Under the corrosion-resisting type of materials are found such metals as wrought iron and commercially pure iron (Armco), together with low-carbon steels bearing slight percentages of such corrosion inhibitors as copper, molybdenum and nickel. While these materials are not offered as being rustless or corrosion-proof, they have proved in long service that under certain corrosive conditions and also exposure to the atmosphere, their life is much longer than that of ordinary steel. Economically they are attractive because, being essentially a steel, their cost is not very much greater than ordinary carbon steel for the same purpose. They are suitable for such purposes as car plates, underframes, firebox sheets, etc.

The second field is a comparatively new development. About ten years ago laboratory experiments indicated that a steel containing chromium around 20 per cent, exhibited certain "stainless" properties. These steels were of fairly high carbon, i.e., about 0.30 per cent, and were first developed for cutlery and other similar purposes. In this original development it was soon found that their resistance to corrosion was not perfect, and depended to a great extent on the heat treatment which had been given the material and on the finish. The next step was to reduce the carbon as low as possible so that the alloy was really a chrome iron rather than a chrome steel. This material was soft and ductile,



Delaware, Lackawanna & Western 4-8-4 type locomotive on which forgings of alloy steel are used

and not dependent for corrosion-resistance to the same degree on either heat treatment or finish. It has proved very acceptable. For the next step we are indebted to German metallurgists when they added nickel to the alloy. This resulted in a material which was superior to either of the other two in resistance to corrosion, in appearance, and in workability, and it is now probably the preeminent type of non-corroding steel. It is, of course, sold under a trade name but is manufactured by several companies in this country.

The economics in the use of this material is that, due to its high price, say 30 cents a pound and higher, it can only be used where the conditions of service are such that the cost is justified either in longer service or in saving cost of replacement of other materials.

It has been used successfully for such purposes as condenser tubes, boiler tubes, superheater parts, etc. To date it is not known that it has been used for firebox sheets, but its use has been contemplated and it would appear that this would be an excellent application on sections where the corrosion conditions are very bad.

Miscellaneous Uses of Alloy Steels

There is no question that wheels, either steel or iron, can be improved by the addition of alloys, such as manganese, chromium, nickel, and molybdenum. There are today in service many thousand wheels in which manganese is used as an alloying element, and experiments are being undertaken by some of the largest wheel manufacturers to improve their product. It is possible to make a chilled-iron wheel containing alloys which will be much stronger and more wear-resisting than the present chilled wheel but the decision to use these wheels must come from the railroads. As one chilled-wheel manufacturer stated some time ago, their business is to trade a new wheel for one discarded by the railroad, plus 80 cents. Naturally, an alloy wheel cannot be furnished on this basis.

A new development which is being watched with interest by the railroad men is that of "nitriding." While the process might still be called in the experimental state, and there is no finality as yet, there is considerable promise that this will prove to be a valuable tool in railroad work. By this method a chrome steel with one per cent of aluminum and with or without other elements* is machined to the final shape ready to be used, heat-treated and then exposed to an atmosphere of ammonia gas at 1,000 deg. F. or slightly less. After some time at this temperature and exposed to this gas the metal takes on an intensely hard surface. It is possible to procure a surface hardness of around 1,000 Brinell, whereas about the hardest steel obtainable by other methods of heat treating is in the vicinity of 600 Brinell. In addition, since the temperature used is comparatively very low, there is practically no distortion or warping of the parts. The value of such a hard material can be easily appreciated and numerous applications to railroad work can be thought of. For example, one might mention piston rods, crosshead guides, crankpins, valve-motion work, and even axles. One manufacturer is today experimenting with main driving axles where the journal alone is nitrided, and the wheel fit and main body are blanked off so that the ammonia gas does not affect them. The value of this remains to be demonstrated.

Nitriding has been developed to a higher degree in Europe than it has in this country, and recently an opportunity was presented of observing the process as practiced by one of the largest companies in Europe. They were nitriding such parts as automobile cylinder blocks, railroad bumpers, valve-motion pins, piston rods, crankpins, pump shafts, gears, and a large variety of other parts, and it was easy to gain the impression that this process was applicable to practically everything.

* The analysis most used in this country is chromium 0.80–1.30, aluminum 0.60–1.20, molybdenum 0.15–0.25.

Discussion

One of the speakers in discussing the use of alloy steels to secure lighter reciprocating and revolving parts on locomotives, pointed out that strength is the primary requirement, but that the steel must have a good degree of toughness and possess the ability to withstand shock and fatigue. With reference to failures of locomotive parts made from alloy steels, he said that the largest percentage was due to mechanical causes such as poor fits, finish or maintenance, and only a few failures were due to inferior quality of the material. Tool marks, sharp fillets and lack of lubrication are the causes of many failures. The same speaker spoke of the various effects of vanadium steel which, he said, are immediately apparent in the improved physical properties and in uniformity of response to heat treatment. The tensile strength is increased and the elastic ratio raised without materially lowering the ductility. Vanadium, he said, imparts thermal stability to steels by hindering the growth of carbide particles, and by restraining the decomposition of the carbides at elevated temperatures. Most of the difficulty encountered in the average railroad blacksmith shop with quenched and tempered forgings, has been due largely to lack of equipment and experience. It was partly to overcome this lack of facilities that the normalizing and annealing treatment of locomotive forgings was developed along with alloy steels.

Another speaker referred to the increased use of springs of chrome-vanadium steel on railroad equipment. He said that carbon-steel springs possessed an elastic limit of about 135,000 lb. per sq. in., while chrome-vanadium springs averaged 190,000 lb. The ultimate strength of carbon-steel springs was around 180,000 lb. per sq. in., while that of chrome-vanadium approximated 200,000 lb. In addition to these tensile properties, he said, it has been found that the safe commercial stress range for carbon steel is somewhere between 55,000 and 60,000 lb. per sq. in. In the case of chrome-vanadium steel it has been found safe to increase this figure from 75,000 lb. to 80,000 lb. per sq. in. This speaker claimed that it was possible to increase the flexibility of chrome-vanadium springs and hence obtain easier riding qualities, obtain increased length of life for the spring under certain service conditions, or reduce the weight of the spring. It is possible, he said, to have any combination of these three features.

The question was asked relative to the effect of cutting vanadium or nickel steels with the acetylene torch, and also the use of the acetylene process for welding breaks and fractures. The answer given by several metallurgists present, was that the carbon content in modern locomotive frames ran so low that welding is safe practice. However, heat treatment should be given in all cases.

Several speakers stressed the fact that the user must keep in mind that alloy steels are special steels for special purposes. There is nothing mysterious about alloy steels but care must be used in their handling. Carbon steels have stood up very well in railroad service, have produced good results and are adequate for use in a large number of applications. There are also possibilities, several speakers pointed out, of improving carbon steel.

Annual Report of Bureau of Locomotive Inspection

The decrease in defects is indicative of the general trend of locomotive conditions

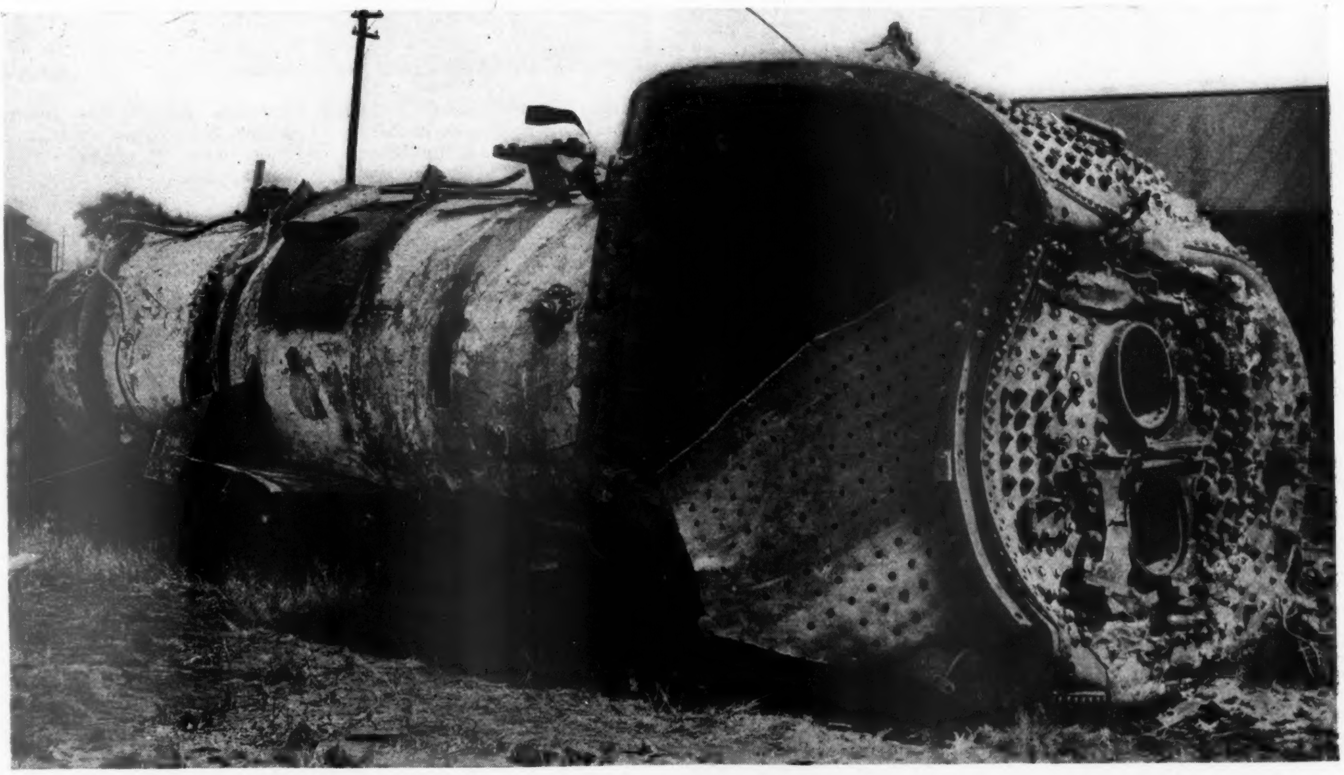
THE eighteenth annual report of the Bureau of Locomotive Inspection of the Interstate Commerce Commission, showing a marked decrease in defective locomotives ordered out of service and in the number of accidents resulting in casualties to persons, indicates the general trend of locomotive conditions throughout the country. For the fiscal year ending June 30, 1929, a total of 96,465 locomotives were inspected, of which 20,185, or 21 per cent, were found defective and 1,490 were ordered out of service. The per cent of locomotives inspected which were found defective compares with 24 per cent in 1928, 31 per cent in 1927, 40 per cent in 1926, 46 per cent in 1925 and 53 per cent in 1924. The reduction in accidents and casualties, together with the percentages of inspected locomotives found defective, is graphically shown in the chart.

As in past years, brake equipment, crossheads, guides and pistons, draw gear, gage cocks, handholds, injectors, packing nuts, piston and valve-stem packing, rods, staybolts, spring rigging, steam pipes and water-glass fittings have been the greatest offenders, but, as seen from the table, they show a marked decrease from preceding years. Defective reverse gears and squirt hose were the cause of the greatest number of accidents during the year covered by the report. The 23 accidents attributed to each of these causes resulted in the injuring of 46 persons. As in preceding years, defective reverse gears, squirt hose, grate shakers, water glasses, rods, handholds and brake equipment were the greatest source of accidents. A summary of all accidents and casualties to persons occuring in connection with steam locomotives as compared with the previous year shows a decrease of 15 per cent in accidents, a decrease of 36.6 per cent in persons killed and 15.8 per cent in persons injured.

An abstract of those sections of the report which deal with crown-sheet failures, staybolts and flue removals follows.

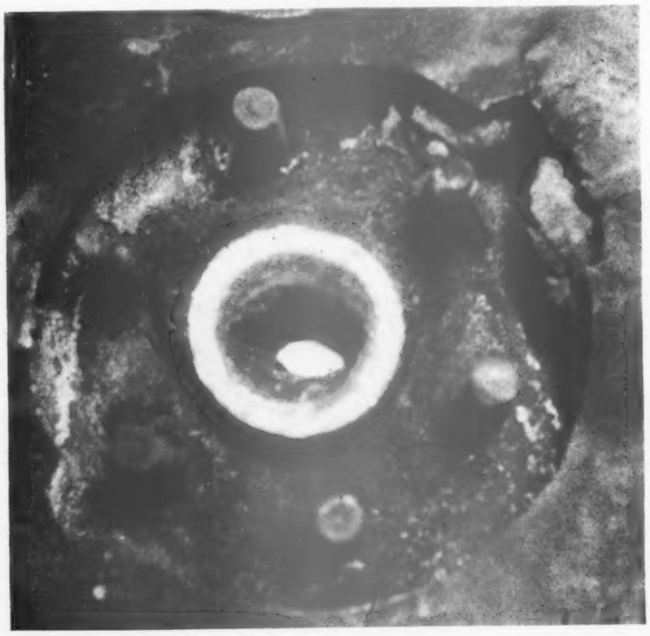
Crown-Sheet Failures

As in former years, boiler explosions caused by crown-sheet failures were the most prolific sources of fatal accidents. Sixty-eight per cent of the fatilities during the year were attributable to this cause, as compared with 67 per cent in the previous year. However,



Result of a crown-sheet failure caused by overheating due to low water—The boiler came to rest 822 ft. ahead of the point of the explosion

there was a decrease of 18 per cent in the number of such accidents, 35 per cent in the number killed, and 15 per cent in the number injured as compared with the previous year, and 68 per cent decrease in the number of such accidents, 68 per cent in the number killed, and 74



Boiler check connection with accumulation of scale which restricted the proper flow of feed water to the boiler

per cent in the number injured as compared with the year 1923.

Careful study of the reports of investigations of boiler explosions caused by crown sheet failures as a result of low water indicates that the reduction in the number of such accidents has been largely, if not en-

Bottom nipple of a water glass entirely closed by mud which trapped water in the glass and resulted in a false indication of water level

tirely, brought about through better maintenance, better water-indicating appliances and better and more dependable feedwater appliances. It is strongly urged, in the interest of safety, that all non-lifting injectors be equipped with a telltale device located in the cab of the locomotive that will give warning to the engineman in charge in the event of failure of the injector. Records show that in the year 1927, 1,760 locomotive fire boxes were equipped with thermic syphons. During the year 1928, 595 additional locomotives were equipped and, in 1929, 645 more were equipped, making a total, at the end of the fiscal year ending June 30, 1929, of 3,000 locomotives thus equipped. During the year there were no accidents reported to the bureau where this equipment was in any way evolved.

Reduced-Body Staybolts

In the fifteenth, sixteenth and seventeenth annual reports attention was called to the danger resulting from

Number of Steam Locomotives Reported, Inspected, Found Defective, and Ordered from Service

Parts defective, inoperative or missing, or in violation of rules	Year ended June 30					
	1929	1928	1927	1926	1925	1924
1. Air compressors	854	1,282	1,679	2,151	1,574	1,221
2. Arch tubes	50	103	127	204	198	272
3. Ash pans or mechanism	104	133	192	211	216	257
4. Axles	15	7	13	8	14	19
5. Blow-off cocks	326	469	650	280	825	965
6. Boiler checks	474	914	1,043	1,200	991	1,329
7. Boiler shell	525	954	1,422	1,888	1,597	2,103
8. Brake equipment	2,715	5,214	6,572	7,062	6,497	6,920
9. Cabs or cab windows	1,562	1,670	2,055	2,666	2,541	1,627
10. Cab aprons or decks	709	852	1,086	1,307	1,165	1,293
11. Cab cards	232	378	575	696	665	758
12. Coupling or uncoupling devices	122	179	289	394	447	398
13. Crossheads, guides, pistons, or piston rods	1,112	2,088	2,602	3,018	2,922	3,577
14. Crown bolts	84	164	235	334	283	418
15. Cylinders, saddles, or steam chests	2,270	3,264	4,526	5,080	4,352	5,712
16. Cylinder cocks or rigging	775	1,007	1,634	1,904	1,801	2,376
17. Domes or dome caps	140	281	388	463	371	494
18. Draft gear	978	1,453	2,037	2,634	2,283	1,981
19. Draw gear	1,030	1,650	2,210	3,140	3,273	4,160
20. Driving boxes, shoes, wedges, pedestals, or braces	1,287	1,990	2,710	3,342	3,241	3,722
21. Fire box sheets	370	730	796	1,129	1,152	1,471
22. Flues	186	464	465	556	524	698
23. Frames, tail pieces, or braces, Locomotive	1,063	1,354	1,682	1,973	2,036	2,580
24. Frames, Tender	232	256	264	373	391	414
25. Gages or gage fittings, Air	248	461	721	886	694	626
26. Gages or gage fittings Steam	504	969	1,425	2,038	1,809	2,026
27. Gage cocks	737	1,413	2,024	3,068	3,081	3,835
28. Grate shakers	190	377	613	720	832	1,006
29. Handholds	856	1,373	2,285	3,100	2,831	2,241
30. Injectors, Inoperative	54	93	84	78	70	94
31. Injectors and connections	2,808	5,563	7,188	8,303	8,064	9,985
32. Inspections or tests not						

Driving-wheel tire that failed after the flange had been built up by fusion welding—The tire, 2 11/16 in. thick, failed when the locomotive had made 71 miles after the welding was applied

made as required	6,638	6,623	8,889	10,646	10,436	9,740
33. Lateral motion	490	699	673	758	659	939
34. Lights, cab or classification	105	118	107	106	86	72
35. Lights, headlights	343	571	835	946	928	904
36. Lubricator or shields	286	500	746	883	704	565
37. Mud rings	411	822	1,073	1,458	1,384	1,901
38. Packing nuts	743	1,265	1,851	2,772	2,761	3,304
39. Packing, piston rod and valve stem	1,076	1,904	2,214	2,489	2,411	3,187
40. Pilot or pilot beams	289	386	507	638	832	967
41. Plugs or studs	303	619	740	1,087	849	1,026
42. Reversing gear	560	967	1,247	1,539	1,274	1,217
43. Rods, main or side, crank pins, or collars	2,418	4,152	5,137	5,683	4,813	6,507
44. Safety valves	119	172	212	270	234	188
45. Sanders	824	1,031	1,268	1,769	2,004	1,806
46. Springs or spring rigging	3,228	4,939	5,956	6,826	5,532	6,335
47. Squirt hose	265	478	644	975	1,008	1,221
48. Staybolts	350	590	631	905	741	916
49. Staybolts, broken	943	1,867	2,373	3,582	3,745	5,320
50. Steam pipes	662	1,020	1,308	1,587	1,590	2,305
51. Steam valves	339	708	774	962	869	981
52. Steps	1,034	1,817	2,440	3,227	2,867	2,829
53. Tanks or tank valves	1,199	1,941	2,747	3,430	3,352	3,393

the use of reduced-body staybolts having telltale holes which do not extend into the reduced section at least ⅝ in. Investigation of reduced-body staybolt breakage shows that failure almost always occurs in the reduced body at or near the filler between the body of the bolt and the enlarged ends, and that telltale holes which do not extend into the reduced section at least ⅝ in. cannot be depended upon to indicate broken bolts.

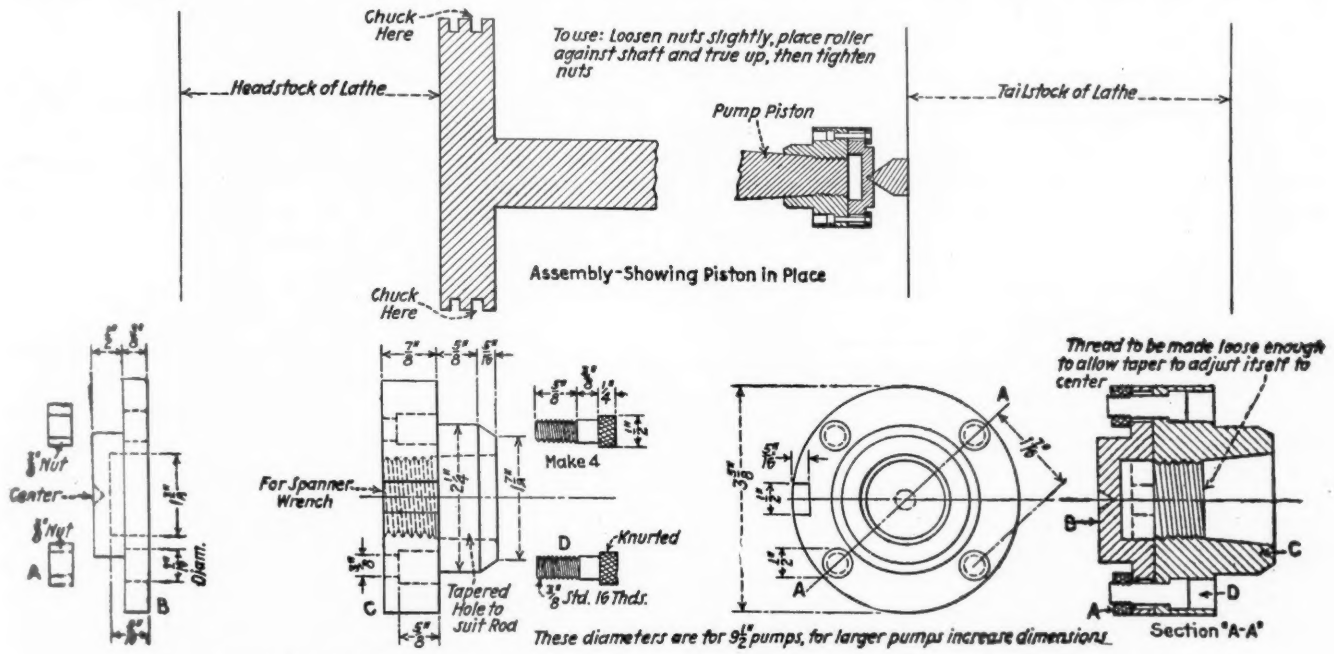
A great majority of broken staybolts are found by leakage through the telltale holes, without the aid of the hammer test. Therefore, if the telltale holes do not extend into the bolts to or beyond the usual point of breakage, they are not only useless as a safety feature but become a distinct menace, because telltale holes are being depended upon to a great extent in determining broken and fractured rigid staybolts. Accidents resulting in serious and fatal injury continue to occur with this type of bolt because of telltale holes not being of sufficient depth to perform the function for which they were intended. The law requires that all rigid staybolts shorter than eight inches shall have telltale holes 3/16-in. in diameter and not less than 1¼-in. in depth in the outer end and that these holes must be kept open at all times. Many such bolts are improperly applied, the reduced body of the bolts being too long to permit full engagement of the threads on the enlarged ends with the threads in the holes in the sheets.

False Center for Compressor Rods

By *W. H. Haynes*

Tool and Air Brake Foreman, Missouri Pacific, Kansas City, Mo.

AIR-compressor piston rods coming from the manufacturer have no centers. The piston head is held on the rod by two nuts with a cotter pin through the outside nut. When an air compressor comes into the shop for repairs it is often necessary to machine the piston rod which requires a center for the lathe. After the piston heads have been removed from the rod several times the center becomes closed and the cotter-pin hole damaged which makes it necessary to ream the center and cotter pin hole. Several repetitions of these



Assembly and details of the false center for holding air compressor rods in a lathe

reaming operations weakens the end of the rod which makes it necessary to scrap a good pump rod.

The illustration shows a false center used to prevent damage to the end of the piston rod. The threads are made sufficiently large to allow the taper fit to adjust itself when the threaded end of the rod is slightly sprung. This feature saves about 20 min. placing a steady rest, and centering and removing the steady rest. After the center has been placed on the rod, and the end of the rod has been placed in the lathe, the nuts marked *A* are slightly loosened and a burnishing roller is placed against the rod close to the taper end, and the rod is revolved to true it up. This operation takes care of sprung rods. The nuts *A* are then tightened again and the machine work completed, after which the center is removed with a spanner wrench.

Steel Castings.—"How Lebanon Adds a New Chapter to the Story of Steel Castings" is the title of a four-page bulletin which has been issued by the Lebanon Steel Foundry, Lebanon, Pa., announcing a scientifically controlled furnace which quenches and draws Lebanon steel castings to a new quality.

The Reader's Page

Have You a Question? Ask it
Have You an Opinion? Express it

Too Many Apprentices

CLEVELAND, OHIO

TO THE EDITOR:

A lot is being written about apprentice training and the preparation of supervisory material. The present apprentice training system is mostly bunk. It is foolish for any young man to learn any of the standard railroad trades covered by apprenticeships at the present time when the trend is toward specialists in every line. The time used in a four-year course of apprenticeship to learn a general trade is of little use to the boy who is apt to graduate as an operator of some particular machine or who will spend the rest of his life performing some particular operation in the course of repairs to a car or locomotive. The supervisors are also specialists; if a supervisor begins in the air-brake department or the boiler department it is very likely that he will continue in that line under the present methods of railroading.

The labor turnover on the average railroad today is so low that a graduate apprentice has very little show of holding down a job after he has served his time. I know of one large road in particular that has a number of apprentices who have worked on their fourth-year apprentice pay rate rather than to go out of their time without a job and with little prospect of being able to get a job at their trade. Nearly all roads seem to have a lot of graduate apprentices who are looking for work. This is certainly a gratifying prospect for an apprentice to look forward to.

It is the common practice for a railroad shop to have a ratio of one apprentice to each five mechanics in the shop. This set-up is made without any consideration of the future of the young man who enters on a four-year apprenticeship. The fair way would be to have the ratio of apprentices based strictly upon the possibility of employment after the apprenticeship is served. This probably would not be satisfactory to the railroads, however, as they can now use apprentices to perform nearly any work of a mechanic and therefore get the work performed cheaper. It is obvious that if the ratio of apprentices was based upon job possibilities there would be less apprentices and more mechanics.

So far as the opportunity of winding up as a supervisor is concerned, it is very slim. More and more the supervisors are being selected from technical graduates from the main offices. It is an old fashioned railroad indeed that goes out into the shops or repair tracks to find a mechanic for a supervisor.

It would be far better if the railroads could train specialists instead of handy men. It is true that agreements with labor organizations are to blame to a great extent but the railroads are not entirely blameless either. As is stands now some roads, with efficient specialized organizations in their shops and with co-ordinating piece-work pay systems, are forcing their employees to earn almost as much money, if not as much, as the supervisors by training the so-called graduate apprentice mechanics to become specialists, thereby increasing their efficiency and earning power.

R. R. HOWARTH

Further Enginehouse Economies

JERSEY CITY, N. J.

TO THE EDITOR:

I was intrigued with the title of the editorial "Further Enginehouse Economies" which appeared in the November, 1929, issue of the *Railway Mechanical Engineer*. The editorial made some lovely suggestions, but say, Mr. Editor, I would like to know where that enginehouse is in the west that has to be watched on account of the tendency to maintain a greater number of locomotives therein than the service actually requires. It is certainly interesting to learn that there is an enginehouse in which there are so many locomotives that the cost to operate the terminal is mounting to—well, I see the figures are not given.

The suggestion to use road power for turn-around runs between long trips, and to utilize locomotives from one division for short trips on a connecting division, is duly noted. Also the suggestion on the use of switching locomotives. There are a lot of other good ideas, but it is no use to republish the editorial.

However, I wonder just how many enginehouse foremen are in that happy situation whereby they can accomplish so much in the line of economy as you have described? How many enginehouse foremen have the authority or opportunity to do all the things advocated at that staff meeting of the locomotive department supervisors of the western road you refer to? There are not many, especially here in the east.

You said a mouthful in your concluding paragraph when you stressed the fact that it is the enginehouse foreman's primary responsibility to "get out the power." He certainly has a fertile field of opportunity to waste or save money for his railroad.

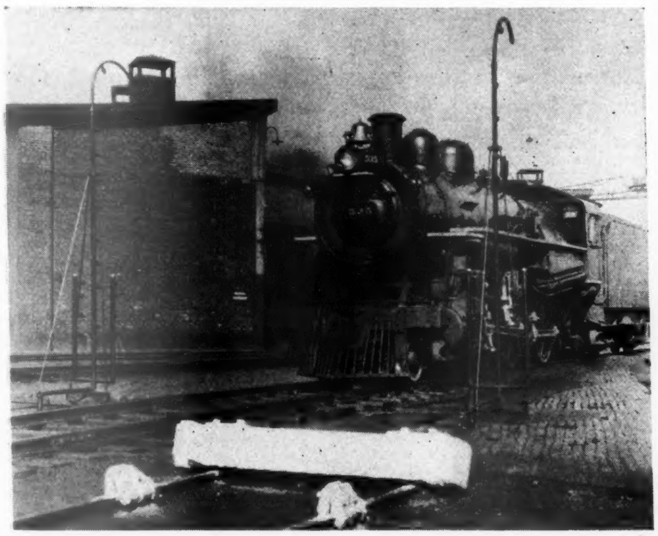
But in order to do this he has to have the power and the facilities with which to perform his "primary responsibility". He cannot be expected to work from ten to twelve hours a day, and be in a fresh state of mind to solve the problems affecting the operation of his terminal, whereby he can save money for his road. He needs a little time for reading and study, and also for recreation,—although many enginehouse foremen have become so impressed with the idea of having to work, that they would not know how to play even if they did have the time. Last, but not least, the superintendent of motive power and the master mechanic might write fewer critical letters, and occasionally dictate one telling a tired and discouraged enginehouse foreman that he is doing a good job.

Yes, all the "further economies" you mention in your editorial can be had, and more to, but the first step toward securing them is to see that the enginehouse foreman has a fair chance.

ANOTHER READER

An Automatic Locomotive Washer

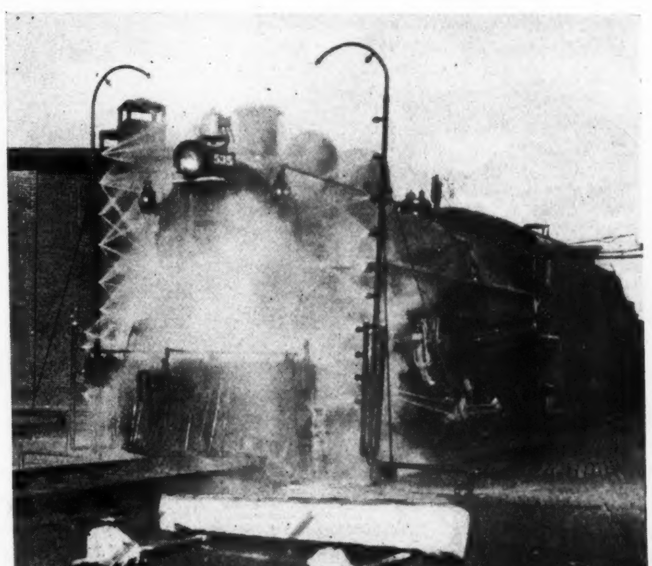
AN automatic locomotive washing machine, which washes an engine in approximately 30 seconds and apparently solves the problem of keeping locomotives clean at a reasonable cost, has recently been placed on the market by the Transportation Equipment Corporation, 230 Park Avenue, New York. The machine, designed and patented by T. A. Mackin, general foreman at the Wilkes-Barre terminal of the Delaware & Hudson, has been in service over two years, during which time it has successfully demonstrated its efficiency and economy. Aside from the cost of making a few changes necessary in the development of any piece of equipment, no money has been expended on maintenance.



The locomotive washer in neutral position

The washer, motor-driven and electrically operated, consists of two vertical units located about 4½ ft. on each side of the track when in neutral position, thus providing sufficient safety clearance. Each unit is composed of three 2-in. iron pipes equipped with a series of small special nozzles and capped on top, the center pipe extending to the height of the locomotive. These units are mounted on roller-bearing wheels and swing into operating position as close as possible to the locomotive passing through the washer.

As soon as the locomotive reaches on insulated section of track directly opposite the washer, the machine goes into operation regardless of the direction in which the engine is moving. The engine, on entering the insulated track section, closes a track circuit which in turn closes a circuit to a small motor that controls the movement of the vertical washing units. The motor, geared vertically, rotates the machine 90 deg., in which position it is automatically clamped to prohibit further movement. The instant the washing units are in position, electrically operated valves are energized which



The washer in operation

open main valves in the hot-water and washing solution lines, the latter being used if desirable but in most instances not a necessary addition to the hot water. Steam

from a ½-in. bleed line, hot water and the washing solution pass through a Y-connection and two Barco flexible joints beneath the tracks to the washing units. The locomotive passing over the insulated section of the track keeps the machine in operation and when the washing is completed the open circuits de-energize the electrically operated main valves in the supply lines, causing them to close. The opening of the track circuit, caused by the locomotive leaving the insulated section of track, automatically reverses the vertically geared motor which now rotates the washing units through 90 deg. into their neutral position. The motor and other electrical equipment necessary for the operation of the circuits, are enclosed in a weather-proof housing which is about 18 in. high.

The usual sight that confronts a visitor at a roundhouse wash rack is the dirty, oily condition on both sides of the track for a distance of between 100 and 150 ft., caused by the engine washer going from one end of the engine to the other with hose and spray. This condition is eliminated with the automatic washer. All the dirt that is washed off an engine will fall in one spot, the space of about 12 ft. in width extending from one side of the track to the other. This space is concreted and will act as a catch basin in catching the water and dirt that drops off the engine while it is being washed.

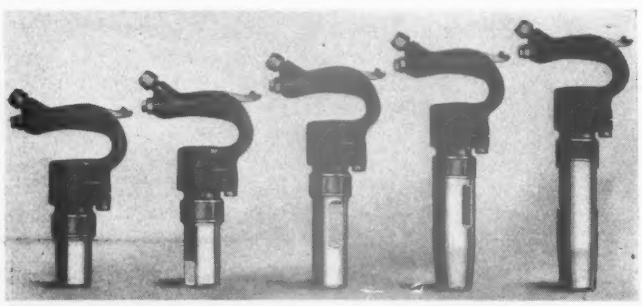
An addition to the time and labor savings which accrue from the use of the machine is its usefulness in winter in removing snow and ice. This permits immediate inspection of the locomotive as soon as it enters the roundhouse and eliminates considerable hand labor. In order to overcome climatic conditions, a small steam line is attached to the device which insures against ice formation and eliminates the freezing hazard entirely. This is a very important factor as at most terminals considerable trouble is experienced during the winter months with washing devices freezing up which results in very little power being washed during severe weather. By eliminating the human element this machine will keep power in a presentable condition at all times as the unit will operate 24 hours a day regardless of the climatic conditions.

The use of this device makes the services of six engine washers unnecessary at each terminal, in addition to the wiping force, as it has been found unnecessary to wipe the locomotives when they are washed daily with the automatic machine. Once a locomotive is thoroughly cleaned it requires only a little daily effort to keep it in that condition. With this machine the effort requires relatively little time.

The washer units can be designed with any number of nozzles and arranged to suit any characteristic design of locomotive. During recent tests the locomotives came off the ash-pit track in a very dirty condition and in less than a minute they were completely washed from top to bottom. The perfect distribution of cleaning solution or hot water left the surface of the jacket of the engines thoroughly cleaned and glossy in appearance.

High-Speed Hammers with Flapper Valves

AN interesting and highly important feature of the high-speed, pneumatic chipping hammers developed by the Ingersoll-Rand Company, 11 Broadway, New York, is the use of a plate valve of the flapper type which flaps down on its seat in a valve box to close the air ports and rises to open them. This action gives quick and full opening and closing of the air ports which results in exceptional power and speed. There is no sliding movement of the valve, resulting in a smooth and positive action and provides for easy holding and sensitive throttling of the hammer. The flapper valve, being a thin beveled plate, permits the hammers to be made shorter in over-all length and also lighter in weight.



Ingersoll-Rand high-speed flapper valve chipping hammers

Another feature is the throttle valve, a combination piston and poppet type, that gives fine graduation of the port opening and is designed to remain tight over a long period of service. The chipping hammers are designed to operate at high speeds, making possible an extremely smooth cut, faster and heavier than has heretofore been attained.

Open type handles are standard on this chipper. The handles screw on the barrels and are securely locked in place by a new type of pinch-bolt arrangement. The exhaust is through the side of the barrel and can be deflected in any desired direction by means of an adjustable exhaust deflector.

The hammers are furnished in five sizes as follows: Size 000, ¾-in. stroke; Size 100, 1-in. stroke; Size 200, 2-in. stroke; Size 300, 3-in. stroke; and Size 400, 4-in. stroke. These five sizes meet all the conditions encountered in the various classes of chipping and calking work.

* * *

Photo by Atlantic Coast Line

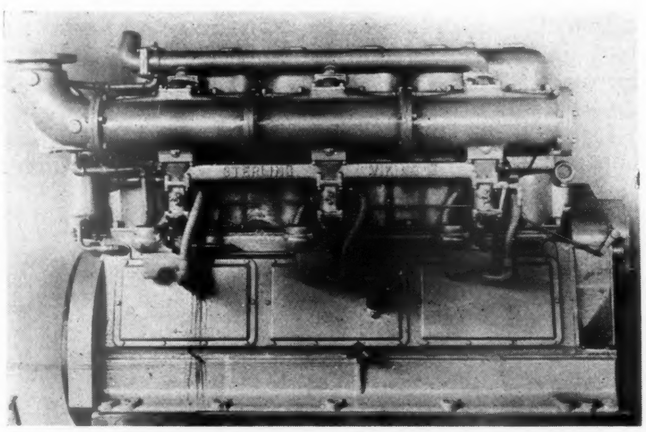
Atlantic Coast Line passenger train near Inverness, Fla.

Sterling Viking Engines for Rail Cars

THE Sterling Engine Company, Buffalo, N. Y., is now manufacturing two types of the Sterling Viking power plants for rail motor cars rated at 380 and 500 hp., respectively. The engines are identical in design except that the smaller one is a six-cylinder unit and the larger one an eight-cylinder unit The six-cylinder engine, weighing 5,250 lb., is built with either a 7½-in. or an 8-in. bore and has a 9-in. stroke. As a cold engine it develops 465 hp. at 1,200 r.p.m. and under radiator cooling conditions it develops 380 hp. at 1,150 r.p.m., all due allowances having been made for the difference in running temperatures. The eight-cylinder unit, weighing 7,850 lb. and built with the same bore and stroke as the smaller unit, develops under working conditions 500 hp. at 1,150 r.p.m.

The high horsepower of the engines is secured with low compression. The compression for both units at 1,100 to 1,200 r.p.m. is 70 to 72 lb. and the mean effective pressures obtained at these speeds are 90.5 lb. and 92 lb. per sq. in., respectively. The two engines are identical in design, and the smaller unit will be illustrated and described, keeping in mind that the differences are only those which might be expected by reason of the greater number of cylinders in the larger plant and the differences in size of equipment to correspond with the greater horsepower.

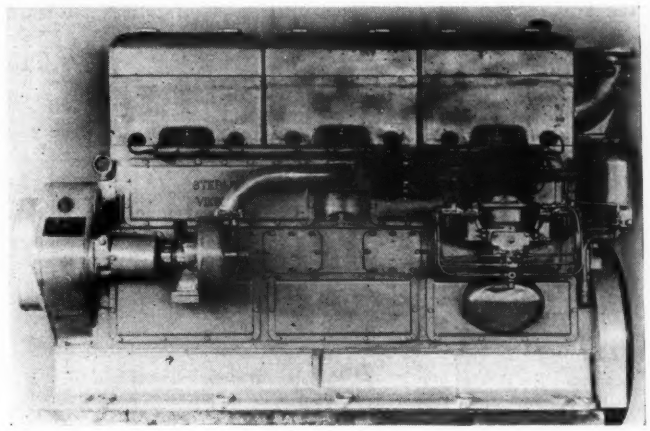
The cylinder block or tank, a gray-iron steel-alloy casting, is equipped with removable cylinder sleeves made from heat-treated, nickle-iron castings. The cylinder heads are of heat-treated, steel-alloy, gray-iron castings and are cast in pairs with a complete water jacket surrounding the ports, valves and spark plug bosses. The crankcase is cast from steel-alloy gray iron and is composed of two parts, an upper and lower portion, both of which are continuous for the full length



Right side of the six-cylinder unit

of the engine. The lower portion is used as an engine lubricating oil tank, with a capacity of 30 U. S. gal. for the six-cylinder engine, and it is equipped with supports for attaching the engine to a foundation or a bed-plate. The upper portion of the crankcase is provided with heavy transverse ribs, supporting the crankshaft and camshaft bearings. It is also provided with large openings that permit access to all connecting-rod and main bearings and makes possible the inspection or renewal of these units without dismantling the engine.

The counterweighted and balanced crankshaft is made of heat-treated chrome-nickel steel and has a bearing diameter of 4 in. The effective length of the bearing at the flywheel end is 6 in., that of the bearing at the timing-gear end is 3⅝ in. and that of the intermediate bearings is 3 in. The crankshaft bearings of the upper crankcase are fitted with shimless, removable shells or liners made with babbitt bearing surfaces on hard bronze backing. The bearing caps are fitted to the crankshaft in guides without shims and are provided with heavy steel plates that are fastened with alloy-steel heat-treated studs and nuts. The flywheel, a rolled-steel forging weighing 368 lb. and 26¼ in. in diameter, is attached to the crankshaft flange with bolts and forms one-half of the generator drive coupling and



Left side of the engine

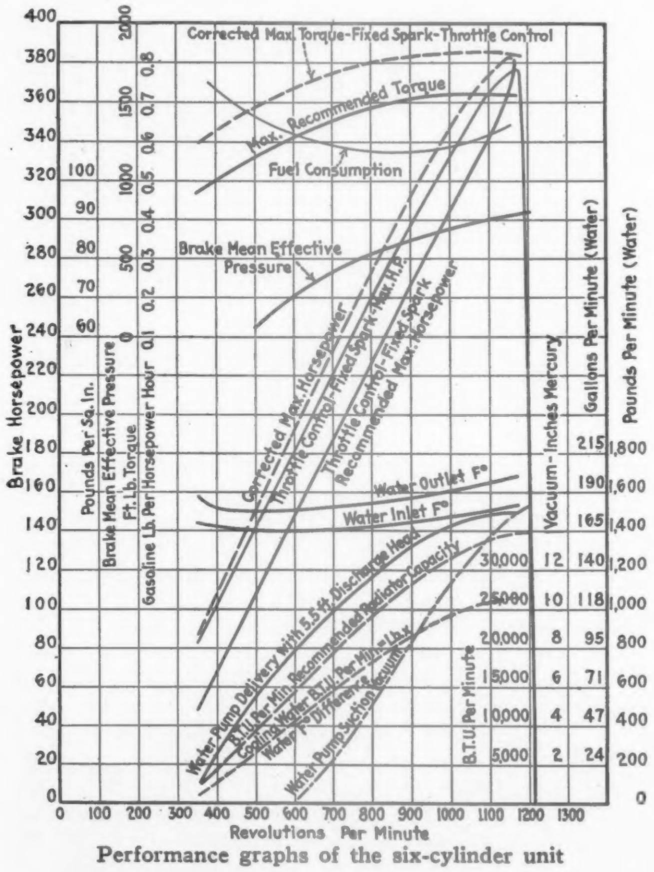
also has a mounting for a self-alining ball bearing to support the generator armature.

The connecting rods, 18 in. from center to center, are of heat-treated I-section steel forgings weighing 23¾ lb. and have split babbitt shells or liners with steel backs fitted into the ground bores without shims. The Sterling constant-clearance piston used is made of aluminum alloy and weighs 13½ lb. complete with rings and piston pin. The piston pin, a 2-in. diameter tube of S.A.E. No. 3120 carburized and hardened steel, with lapped finish, is held in position by washers overlapping the end of the bearing.

The camshaft is of carburized and hardened steel with ground cams and bearing surfaces. The bearing at the timing-gear end is 2⅛ in. in diameter and 3-3/16 in. long; the first and second intermediate bearings are 2 in. long, while the diameters are 2¾ in. and 2-47/64 in., respectively; the flywheel end bearing is 2⅛ in. in diameter and 2-7/16 in. long. The camshaft is operated by 3-in.-face gears from the crankshaft and the water pump and accessories are driven by 2⅛-in. face gears from the camshaft. Right-angle spiral gears are provided for the oil pump, ignition, fuel pumps and speed indicator. Valve operation from the camshaft consists of roller cam followers, operating in a bath of oil, and hardened steel push rods, coupled to the rocker arms by steel tubing with ball-and-socket connections. The rocker arms of drop-forged steel, carburized and hardened, operate a tee-shaped equalizer provided with adjustments, contacting with each of two valves. The rockers are drilled for lubrication of the ball ends and are provided with a bronze bushing oscillating on a hardened steel shaft supported in a bracket.

The lubricating system is contained in the engine, ex-

cept for the oil cooler and connections between it and the engine Oil under pressure is supplied to the main bearings, connecting-rod bearings and timing gears and bearings by a gear type pump which has its suction in the cool-oil compartment of the lower base. A scavenging pump circulates oil from the main storage in the lower base through the cooler into the cool-oil compartment, which is provided with a by-pass valve that permits the direct return of the oil to the lower base when the oil-cooling radiator is cold. Screens in the oil sump or reservoir that protect the pressure and cooler pump suctions are easily accessible and can be removed through handhold openings in the crankcase. An oil filter between the pressure pump and the distributing manifold is provided with a by-pass valve which permits a continuance of oil flow to the bearings if the strainer becomes dirty or clogged. A double-hand pressure gage is used to indicate the difference in pressure across the filter screens and show the necessity of



Performance graphs of the six-cylinder unit

cleaning the filtering elements when a difference of 15 lb. per sq. in. of pressure exists.

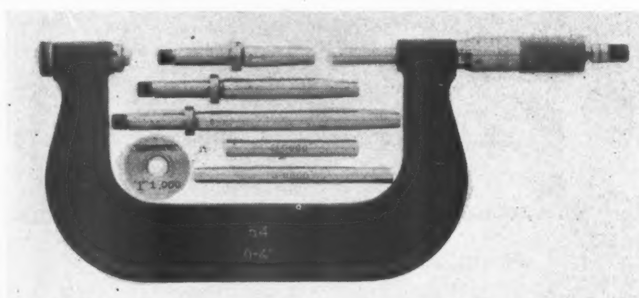
The water-jacket spaces are designed to eliminate steam pockets and to provide large water spaces and complete circulation around the cylinders, combustion chambers, spark-plug bosses, valve seats and ports. The water is circulated by a centrifugal pump mounted on the engine and driven from the timing gears. Radiators and water-storage tanks are provided by the builders of the rail motor cars in which the engines are to be used.

Four independent battery ignition circuits controlled by lamp regulators are used. Each ignition circuit is provided with a separate switch for testing. Two North East double distributors, each with two interrupters, are used, one for each circuit. Each of the circuits is provided with a low-voltage transformer coil in series with nichrome-wire resistance that, together with the testing switches, is contained in a control box mounted on the engine. This box also contains potential regulators for short circuiting the resistance of two circuits during voltage drop, which occurs when cranking the engine. By using this form of regulation, the spark of the two circuits, provided with voltage control, will equal or exceed the normal spark strength, which is desirable during cranking. A fixed spark setting is used and the timing interrupters are synchronized by using the ammeter in the control box when setting the timing. One interrupter is set to correct timing mechanically and the engine is rotated until the circuit is open. The mechanically timed circuit switch is then opened and the other circuit switches sucessively closed, and the other interrupters timed and set for the same cylinder according to the ammeter indication. It is possible to synchronize all four spark settings in the above manner. Ignition is timed for 19 deg. of crankshaft travel before the top piston center of the compression stroke.

A 2-in. carburetor of the Schebler Model S type is provided for each two cylinders, and is suitable for standard automotive gasoline as a fuel. Throttle valves, installed between the carburetors and the gas inlet manifold, are controlled by the engine governor and limit the maximum engine speed. Two diaphram-type fuel pumps are used, either of which will supply the engine with sufficient fuel.

Brown & Sharpe Micrometer

THE Brown & Sharpe Manufacturing Company, Providence, R. I., recently announced its No. 54 micrometer which has a measuring range of from zero to 4 in. by thousandths of an inch. Although this micrometer has been especially designed for use in automotive production and service shops, it has a number of features which makes it useful in locomotive machine shops, especially in production shops and tool rooms.



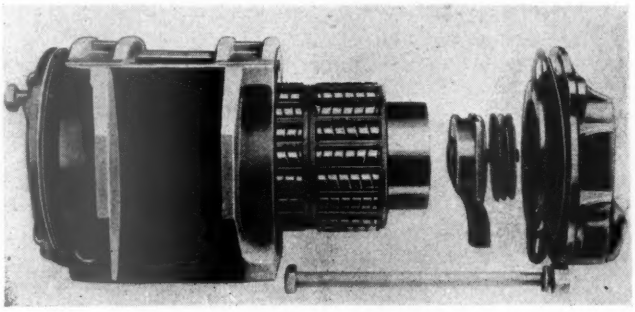
Micrometer with a range of from zero to 4 in.

The No. 54 micrometer is provided with four anvils of different lengths which can be used in the frame as desired. Referring to the illustration, the short anvil measures 3 in. to 4 in. The next shortest anvil measures 2 in. to 3 in. and so on. The shape of the frame of the micrometer makes it possible to measure work up to 4 in. in diameter. This micrometer is furnished with a ratchet stop, and a set of three standards, unless otherwise ordered.

The Fafnir-Melcher Roller Bearing

THE Fafnir Bearing Company, Booth street, New Britain, Conn., has recently placed on the market the Fafnir-Melcher roller bearing for car journals. This bearing is interchangeable with existing plain journal bearings and is designed to withstand the severe conditions of railroad service and yet is scientifically constructed to run free without heating up.

Simplicity of construction marks the Fafnir-Melcher box throughout. A sleeve comprising the inner race, a roller assembly, and an outer housing in which the roller path is integral are the three main parts. The sleeve, shrunk or pressed on the axle, furnishes a hard and wear-resisting surface for the operation of the rollers. Alignment and flexibility are carefully provided for in the design of the box. Rollers need take only radial load as all lateral thrust is absorbed by bronze thrust bearings which, because of effective lubrication, have long life. Balanced construction assures an equal distribution of load over the entire bearing area.



The Fafnir-Melcher box disassembled

The housing or box is composed of three parts: the front cover, housing the thrust bearing and lubricating wick; the rear cover, containing the oil seal grooves and dust guard, and the center member, in which is embodied the roller path equalizer seat, pedestal flanges, and oil reservoir.

A very hard, tough special alloy is used for this center member, and the roller path is heat-treated and ground to a minimum tolerance, thus assuring accurate fits, concentricity, and a wearing surface equal or better than that of the separate outer-race type. Another advantage of this unusual construction is the greater wall thickness permitted, which increases the strength of the box, which is retained within A.R.A. standard pedestal dimensions.

The roller assembly consists of two sets of flexible rollers each contained in a spacer-bar cage. The separator bars between the rollers permit much better lubrication, as well as assure positive alignment of the individual rollers at all times. All parts are manufactured of alloy steel to provide a rigid and rugged assembly.

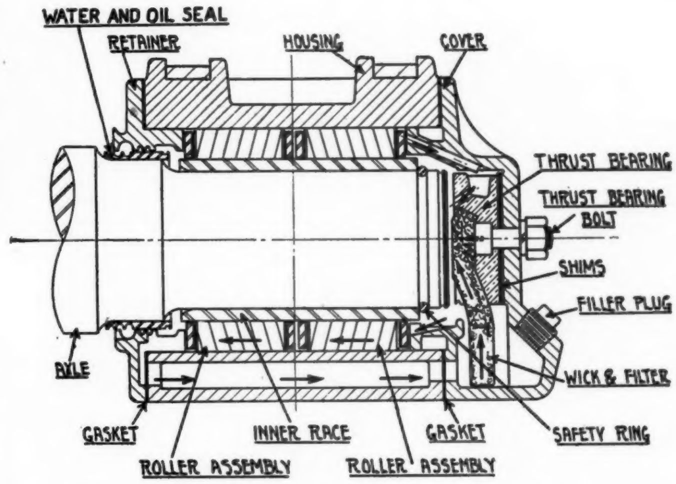
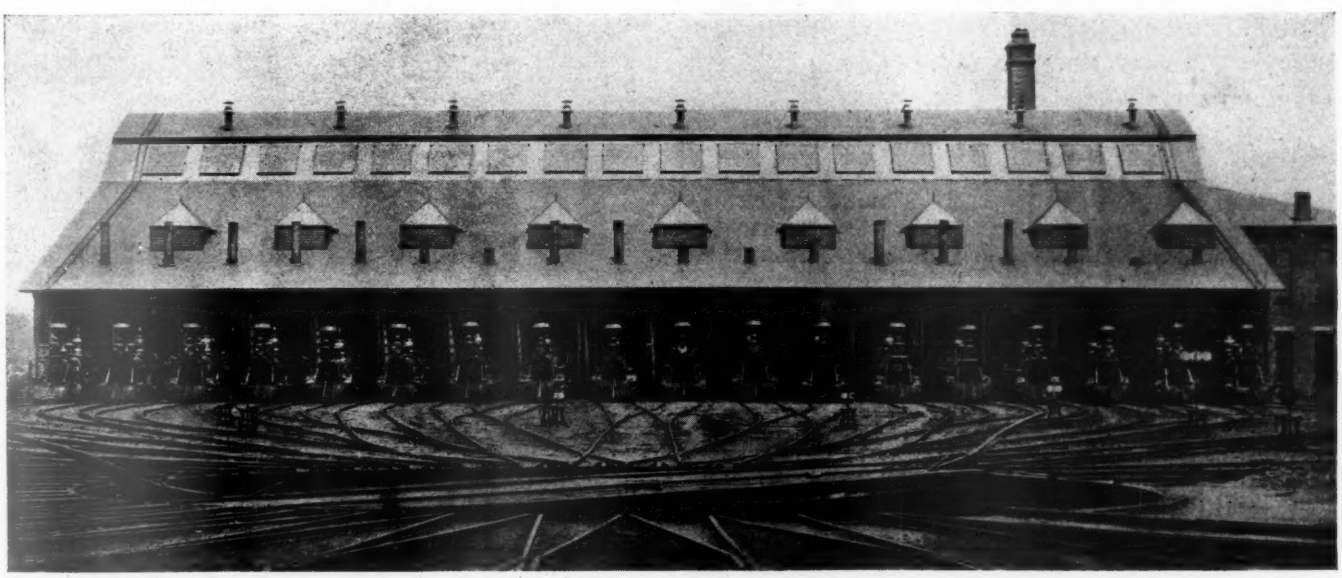


Diagram of the lubrication system of the bearing

A feature of the Fafnir-Melcher bearing is the circulating and filtering lubricating system, which provides a constant circulation or flow of from 15 to 30 drops of clean, filtered oil per minute through the bearing. The essential features are a wick which draws oil from the reservoir to the axle, from whence by centrifugal action it is carried to the roller path, through the rollers, and back to the well again.

* * *



Erie machine shop and "square" house at Meadville, Pa.—Photograph taken in 1870

Combination Disc and Production Grinder

THE illustrated combination disc and production grinder, manufactured by the Hammond Machinery Builders, Inc., Kalamazoo, Mich., makes a desirable installation where disc-grinding operations are limited, as the solid grinding wheel can be used for tool or casting grinding. The machine is made in four sizes, 2, 3, 5, and 7½ hp. capacity, for 220 and 440-volt, 25 to 60-cycle alternating current, and 110- and 220-volt direct current. Standard equipment includes one steel adjustable wheel guard, steel disc, and plain table, although a Universal lever-feed table can be furnished in place of the plain table if so desired. The machine can also be fitted with discs on both ends, with either the plain or universal lever tables.

These machines are equipped with totally enclosed

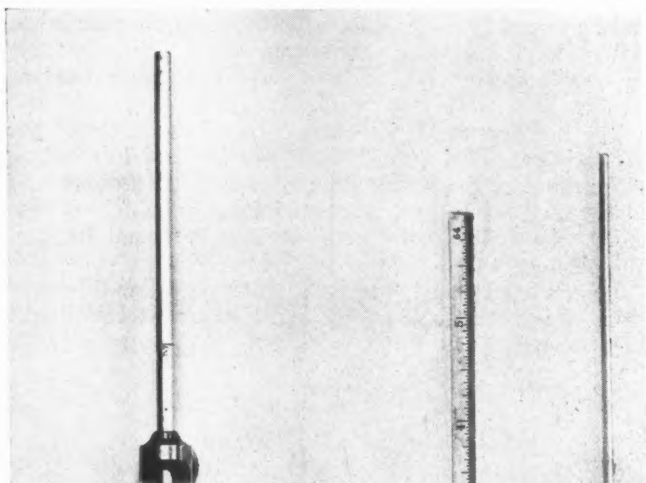
A combination grinder for limited disc operations

40-deg. C-type motors, fitted with a motor air cleaner (patent applied for) which supplies clean air to the motor windings, eliminating grit and dirt before it enters the motor. This insures an efficient and cool operating unit. They are equipped with push-button control and automatic motor starter having thermal overload protection, low-voltage, and phase-failure protection. The automatic starter is conveniently mounted on the inside of the pedestal door for convenience of inspection and resetting. The machine is equipped with ball bearings completely enclosed and protected from dust and grit by double labyrinth seals. They are designed and mounted to take both radial and lateral thrust. Liberal oil reservoirs are provided with convenient oil cups, oil-level gauge and drain plug for ease of flushing the bearing chamber. The oil chamber is designed so that surplus oil will flow away from the motor windings through an overflow located at the wheel end of the bearing compartment. The discs are machined on both sides so that two disc wheels can be mounted at one time. After one is worn, the disc can be reversed. In this way, the disc renders twice the number of service hours with one operation of changing and mounting disc wheels. Wheel presses for mounting discs can be supplied.

Drill and Depth Gage

THE drill-point and depth gage, No. 617, developed by the Brown & Sharpe Manufacturing Company, of Providence, R. I., can be used either for checking the angles of drill points when grinding them and determining whether the point is central, or as a depth gage for holes as small as 3/32 in. in diameter. The graduated bevels on the head are ground to 59 deg. The gage, furnished with a 6-in. rule and a 6-in. rod, is furnished with either the English or metric system.

The graduated-rod depth gage, No. 614, has a wide base and a slender rod, making this tool convenient for use in measuring holes of either large or small diameter. The rod is graduated in 1/64 in. for the first three inches. The first 5/8 in. of the rod is 1/16 in. in diameter and the remainder is 1/8 in. in diameter. The base is 2 in. wide and 1/4 in. thick.

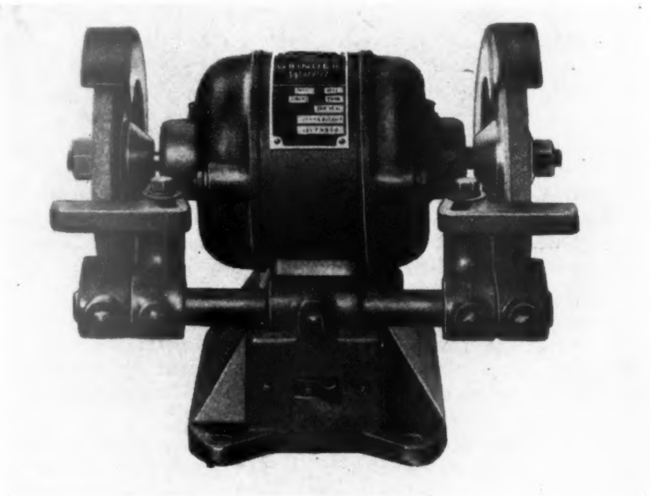


Gage No. 614 Gage No. 617

The B. & S. drill and depth gages

A Portable Bench Grinder

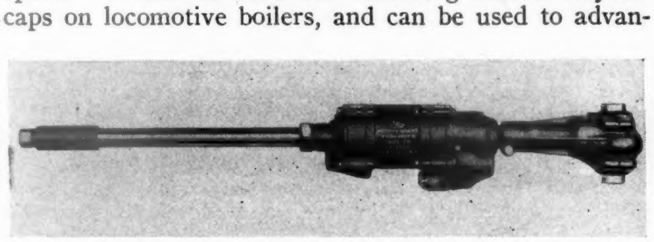
THE Red Streak portable electric bench grinder has recently been added to the line of electric labor-saving tools of Wappat, Inc., 51 North Braddock avenue, Pittsburgh, Pa. It is designed for general grinding purposes and tool sharpening, and while it is light enough to move from place to place conveniently, it is of sturdy construction and powerful. The two 6-in. grinding wheels are covered with adjustable safety guards making it possible to grind at any position on the circumference of the wheels. The grinder is so balanced that there is practically no vibration. The switch is located at the base and the rubber-covered cable is heavy enough to eliminate any chance of breaking from constant use.



The Red Streak portable bench grinder

Thor Rotary Pneumatic Wrench

THE Independent Pneumatic Tool Company, 600 West Jackson boulevard, Chicago, has designed a new type of pneumatic wrench, known as the Thor 278 rotary pneumatic wrench. A particular feature of this wrench is that it develops large power at high speed. It can be used for removing rusted staybolt caps on locomotive boilers, and can be used to advantage on the throat sheet where it is difficult to get in with ordinary tools. This wrench can also be used to break nuts loose from cylinder studs without backing the stud out. Dome nuts, superheater-unit nuts and frame bolts can be removed with it.



The Thor pneumatic wrench designed for severe service

The speed of the wrench is controlled by a governor, and heavy-duty ball bearings are used. A renewable rotor liner saves the cylinder from excessive wear and tends to reduce maintenance costs. The Thor wrench has a speed of 170 r.p.m. The weight is 40 lb.

A Test of Fireproof Car Flooring

AN unusual demonstration of the effectiveness of fire resisting material used for passenger car flooring was recently given when a fire on one of the larger railroads destroyed considerable property including seven passenger cars. The flames were so intense that it was impossible to move these cars out of the danger zone and the result was that all but two were completely destroyed.

In the investigation subsequently conducted to determine what might be salvaged a very interesting observation was made. In practically every instance it was found that the equipment underneath the car represented a large proportion of the salvageable materials. Notwithstanding the intensity of the flames which resulted in the glass becoming molten and running down the sides of the cars, distortion of steel members, etc., the flooring proved to be entirely fireproof, accounting for the small damage to the mechanical and electrical apparatus underneath the car. Tucolith flooring, manufactured by the Tuco Products Corporation, New York, was used in these cars.

Interior of one of the damaged cars

Roller Chain Data.—The Link-Belt Company, Indianapolis, Ind., has just published a manual, Roller Chain Data Book No. 1257, which illustrates the construction of Link-Belt chains and wheels and presents many pages describing the proper selection and application of Link-Belt roller chain on light and heavy duty industrial drives and on all types of machinery, tractors, trucks, farm implements, etc. An additional feature of value in this 96-page book is the presentation of lists of wheels up to 81 teeth.

News of the Month

The Missouri Pacific contemplates the construction of a locomotive terminal and shops near Topping and Nicholson avenues, Kansas City, Mo., during 1930, at an approximate cost of $750,000.

Tests of Running Boards Proposed

John L. Rogers, special examiner of the Interstate Commerce Commission, has submitted a proposed report on the petition filed by the train-service brotherhoods asking that the commission modify its order of March 13, 1911, which provided that running boards on box and other house cars shall be made of wood, so as to permit the use of metal running boards. The report says that sufficient good cause has not been shown to justify a general modification of the order, but that it should be modified to a limited extent so as to permit for test purposes the use of cars equipped with running boards made of material other than wood. Mr. Rogers recommends that the record in the case be held open to afford the railroads and brotherhoods an opportunity to submit evidence as to the results of the tests provided for.

Fuel Association Committees

At a meeting of the International Railway Fuel Association Executive Committee in December, the following committees were chosen to make reports at the 1930 convention:

Diesel Locomotives.—Chairman Clarence Roberts, assistant road foreman of engines, Pennsylvania, West Philadelphia, Pa.

Front Ends, Grates and Ashpans.—Chairman Professor E. C. Schmidt, University of Illinois, Urbana, Ill.

Fuel Distribution and Statistics.—Chairman J. M. Nicholson, fuel conservation engineer, Atchison, Topeka & Santa Fe, Topeka, Kan.

Fuel Stations.—Chairman W. T. Krausch, engineer of buildings, Chicago, Burlington & Quincy, Chicago.

Inspection and Preparation of Coal.—Chairman F. X. Nachtmann, mining engineer, St. Louis-San Francisco, St. Louis, Mo.

Locomotive Firing Practice—Coal.—Chairman O. E. Wolden, fuel supervisor, Minneapolis, St. Paul & Sault Ste Marie Minneapolis, Minn.

Locomotive Firing Practice—Oil.—Chairman J. N. Clark, chief fuel supervisor, Southern Pacific, San Francisco, Cal.

New Locomotive Economy Devices.—Chairman E. A. Kuhn, engineer of motive power, New York Central & St. Louis, Cleveland, O.

Stationary Plants—Coal Fired.—Chairman J. S. Morris, general foreman, New York, Chicago & St. Louis, Chicago.

Stationary Plants—Oil Fired.—Chairman R. W. Hunt, fuel supervisor, Atchison, Tokepa & Santa Fe, Los Angeles, Cal.

Steam Turbine Locomotives.—Chairman L. P. Michael, mechanical engineer, Chicago & North Western, Chicago.

Storage of Coal and Oil.—Chairman H. Morris, superintendent of fuel and locomotive performance, Central Railroad of New Jersey, New York.

A. R. A. Letter Ballot Returns

The returns from eight letter ballots submitted to the members of the American Railway Association, Mechanical division, as a result of the action of the division at its 1929 annual meeting in Los Angeles, Cal., were announced by the secretary in circulars dated November 30, as follows:

Brakes and Brake Equipment.—The committee on this subject recommended a type of auxiliary-reservoir release valve which, as a result of the favorable letter ballot, is approved as standard and recommended practice, effective March 1, 1930.

Couplers and Draft Gears.—The committee on this subject recommended a modified design of toggle for bottom-operated Type D couplers which, as a result of the favorable letter ballot, is adopted as a standard and recommended practice, effective March 1, 1930.

Wheels.—The committee on this subject recommended a journal-length gage and a master gage for checking standard A.R.A. wheel-defect gages which, as a result of the favorable letter ballot, are adopted as standard and recommended practice, effective March 1, 1930.

Loading Rules.—The committee on this subject divided its recommendations into 22 propositions for modification of the A.R.A. loading rules, all of these propositions, as a result of the favorable letter ballot, being approved, effective March 1, 1930.

Lubrication of Cars.—The recommendations of the committee on this subject were divided into four propositions for modification of the standard method of packing journal boxes, for adoption of standard specification for dust guards, for the revision of standard specifications for new journal box packing waste and for the adoption of specifications for new car oil. All of these propositions, as a result of the favorable letter ballot, are approved, effective March 1, 1930.

Car Construction.—The recommendations of the committee on this subject were divided into five propositions for the revision of standard specifications for journal-box lids, standard lettering and marking of cars, classification and lettering of cars, arch-bar column and journal-box bolts and column castings, and the adoption of minimum dimensions from top of rail to bottom of truck side frames. All of these propositions, as a result of the favorable letter ballot, are approved, effective March 1, 1930.

Locomotive Design and Construction.—The committee on this subject divided its recommendations into five propositions for the design of various locomotive details, including crossheads and guides, bronze rings between main-rod sides and crossheads, back cylinder heads, side-rod knuckle joints and tender-tank hose. In addition, one proposition was advanced to adopt as recommended practice, specifications for tender-tank hose. Another suggested a formula for computing the tractive force of locomotive boosters. All of these propositions are approved as a result of the favorable letter ballot, effective March 1, 1930.

Specifications and Tests for Materials.—The recommendations of the committee on this subject were divided into four propositions for the revision of standard specifications for air-brake hose gaskets, cast-steel truck side frames, truck bolsters and coupler yokes. Five new specifications were prepared for normalized and drawn carbon-steel forgings and alloy-steel material for several specialized uses in the construction of nitric-acid tank cars. All of these propositions, as a result of the favorable letter ballot, are approved, effective March 1, 1930.

Clubs and Associations

The next regular meeting of the Steel Founders' Society of America will be held at Pittsburgh, Pa., on Thursday, Dec. 12.

A. S. M. E. Elects Officers

The following officers of the American Society of Mechanical Engineers were elected by letter ballot of the members to serve as directors of the society for the year 1930: President, Charles Piez, Chicago; vice-presidents, Paul Doty, St. Paul, Minn.; Ralph E. Flanders, Springfield, Vt.; Ernest L. Jahncke, Washington, D. C., and Conrad N. Lauer, Philadelphia, Pa.

Mr. Piez, who is chairman of the board of the Link-Belt Company, received his technical education as a mining engineer at the School of Mines, Columbia University. Immediately after his graduation in 1889 he entered the employ of the Link-Belt Engineering Company in Philadelphia as an engineering draftsman. Seventeen years later, in 1906, after he had attained to the position of chief engineer and general manager of the Philadelphia Works of the Link-Belt Company, he was elected president of the Link-Belt Company, a consolidation of the Link-Belt Machinery Company, Chicago; the Ewart Manufacturing Company, Indianapolis, Ind., and the Link-Belt Engineering Company, Philadelphia. In 1917 Mr. Piez was appointed vice-president and general manager of the United States Shipping Board Emergency Fleet Corporation and later succeeded Charles M. Schwab as director general of the corporation. He resigned as director general on May 1, 1919, and continued as president of the Link-Belt Company until 1924 when he was appointed chairman of the board.

Mr. Piez is also a member of the American Institute of Mining and Metallurgical Engineers; Society of Naval Architects and Marine Engineers; Western Society of Engineers, and Engineers Society of Northeastern Pennsylvania.

The following list gives names of secretaries, dates of next or regular meetings and places of meeting of mechanical associations and railroad clubs.

Air-Brake Association.—T. L. Burton, Room 5605 Grand Central Terminal building, New York. Next meeting, Minneapolis, Minn.

American Railway Association.—Division V.—Mechanical.—V. R. Hawthorne, 431 South Dearborn St., Chicago. Annual convention June 18-25, Atlantic City, N. J.

Division V.—Equipment Painting Section.—V. R. Hawthorne, Chicago. Next meeting, Sept. 9-11, 1930, Chicago.

Division VI.—Purchases and Stores.—W. J. Farrell, 30 Vesey St., New York. Annual convention June, 1930, Atlantic City, N. J.

American Railway Tool Foremen's Association.—G. G. Macina, 11402 Calumet avenue, Chicago.

American Society of Mechanical Engineers.—Calvin W. Rice, 29 W. Thirty-ninth St., New York. Railroad Division—Paul D. Mallay, chief engineer, transportation department, Johns-Manville Corporation, 292 Madison avenue, New York.

American Society for Steel Treating—W. H. Eiseman, 7016 Euclid Ave., Cleveland, Ohio.

American Society for Testing Materials.—C. L. Warwick, 1315 Spruce St., Philadelphia, Pa. Annual meeting Atlantic City, N. J., June 23-27.

American Welding Society.—Miss M. M. Kelly, 29 West Thirty-ninth street, New York.

Association of Railway Electrical Engineers.—Joseph A. Andrucetti, C. & N. W., Room 411, C. & N. W. Station, Chicago, Ill.

Canadian Railway Club.—C. R. Crook, 129 Charon St., Montreal, Que. Regular meetings, second Tuesday in each month, except June, July and August, at Windsor Hotel, Montreal, Que. Next meeting January 13, 7:45 p. m. A paper on Circus Organization or Operations will be presented by G. F. Meighan, general manager, Ringling Bros.

Car Foreman's Association of Chicago.—G. K. Oliver, 7836 So. Morgan street, Chicago, Ill. Regular meeting, second Monday in each month, except June, July and August. Great Northern Hotel, Chicago, Ill.

Car Foremen's Club of Los Angeles.—J. W. Krause, 514 East Eight St., Los Angeles, Cal. Meetings second Friday of each month in the Pacific Electric Club building, Los Angeles, Cal.

Car Foremen's Association of St. Louis.—F. G. Weigman, 720 North Twenty-third street, East St. Louis, Ill. Regular meeting first Tuesday in each month, except June, July and August, at Broadview Hotel, East St. Louis, Ill. Next meeting January 7, 8 p. m. A paper on Safety First will be presented by P. A. Lovely of the Pullman Company. Motion pictures.

Central Railway Club.—Regular meeting, second Tuesday each month, except June, July and August, at Hotel Statler, Buffalo.

Chief Interchange Car Inspector's and Car Foremen's Association.—See Master Car Builders' and Supervisors' Ass'n.

Cincinnati Railway Club.—D. R. Boyd, 3328 Beekman St., Cincinnati. Regular meeting second Tuesday, February, May, September and November.

Cleveland Railway Club.—F. L. Frericks, 14416 Adler Ave., Cleveland, Ohio. Meeting first Monday each month, except July, August and September at Hotel Hollenden, East Sixth and Superior Ave.

International Railroad Master Blacksmith's Association.—W. J. Mayer, Michigan Central, 2347 Clark Ave., Detroit, Mich. Next meeting September, 1930, Hotel Sherman, Chicago.

International Railway Fuel Association.—C. T. Winkles, Room 707, LaSalle Street Station, Chicago. Next meeting May 6-9, 1930 Hotel Sherman, Chicago.

International Railway General Foremen's Association.—William Hall, 1061 W. Wabash street, Winona, Minn.

Louisiana Car Department Association.—L. Brownlee, 3212 Delachaise street, New Orleans, La. Meetings third Thursday in each month.

Master Boilermaker's Association.—A. F. Stiglmeier, secretary, 29 Parkwood St., Albany, N. Y. Annual meeting May 21-24 William Penn Hotel, Pittsburgh, Pa.

Master Car Builders' and Supervisors' Association.—A. S. Sternberg, master car builder, Belt Railway of Chicago, Chicago.

New England Railroad Club.—W. E. Cade, Jr., 683 Atlantic Ave., Boston, Mass. Regular meeting second Tuesday in each month, excepting June, July, August and September. Copley-Plaza Hotel, Boston. Next meeting January 14, 6:30 p. m. A paper on Co-ordination of Rail and Air Service will be presented by the Hon. Wm. P. MacCracken, Jr., formerly assistant secretary of Commerce for Aeronautics, United States.

New York Railroad Club.—Meetings third Friday in each month, except June, July and August, at 29 West Thirty-ninth St., New York. Mrs. M. E. Hartman, acting secretary, 26 Cortlandt street, New York. Next meeting January 17. Air Brakes will be discussed by S. G. Down, vice-president, Westinghouse Air Brake Company, Wilmerding, Pa.

Pacific Railway Club.—W. S. Wollner, P. O. Box 3275, San Francisco, Cal. Regular meetings, second Tuesday of each month in San Francisco and Oakland, Cal., alternately.

Railway Car Department Officers' Association.—See Master Car Builders' and Supervisor's Association.

Railway Club of Greenville.—Paul A. Minnis, Bessemer & Lake Erie, Greenville, Pa. Meetings third Thursday of each month, except June, July and August. Next meeting January 21, 6:15 p. m., at Zion's Reformed Church. A paper on Safety and Welfare will be presented at this meeting which will be in charge of T. C. Whitman, chairman of Central Safety Committee.

Railway Club of Pittsburgh.—J. D. Conway, 515 Grandview Ave., Pittsburgh, Pa. Regular meeting fourth Thursday in month, except June, July and August. Ft. Pitt Hotel, Pittsburgh, Pa.

St. Louis Railway Club.—B. W. Frauenthal, M. P. O. Drawer 24, St. Louis, Mo. Regular meetings, second Friday in each month, except June, July and August.

Southern and Southwestern Railway Club.—A. T. Miller, P. O. Box 1205, Atlanta, Ga. Regular meetings third Thursday in January, March, May, July, September and November. Annual meeting third Thursday in November, Ansley Hotel, Atlanta, Ga.

Southwest Master Car Builders' and Supervisors' Association.—See Master Car Builders' & Supervisors' Association.

Travelling Engineers' Association.—W. O. Thompson, 1177 East Ninety-eighth St., Cleveland, Ohio. Next meeting September 23-26, 1930, Hotel Sherman, Chicago.

Western Railway Club.—W. J. Dickinson, 189 West Madison St., Chicago. Regular meetings, third Monday in each month, except June, July and August.

Supply Trade Notes

J. H. Hollinger, Philadelphia representative of the Landis Tool Company, Waynesboro, Pa., died on November 18.

Frederick L. Wells, president of the Duner Company, Chicago, died on December 9, after a long illness.

N. B. McRee has been appointed railroad sales representative of the United States Graphite Company, Saginaw, Mich., succeeding Walter R. Pflasterer, resigned.

Prescott I. Johnston, for many years shop superintendent of the Consolidated Machine Tool Corporation of America, died on December 14 at Rochester, N. Y.

S. L. Williams has been appointed district engineer for the Eastern District of the Westinghouse Air Brake Company, with headquarters at New York.

The Milwaukee Electric Crane & Hoist Corporation is planning the construction of a 50-ft. by 60-ft. addition to its shop at Milwaukee.

The National Aluminate Corporation, Chicago, has opened an office at suite 1006, 11 West Forty-Second street, New York, H. A. Marshall, eastern railway representative, being in charge.

H. M. Davison, eastern territory manager of excavator sales for the Harnischfeger Sales Corporation, has been promoted to general sales manager with headquarters at Milwaukee, Wis.

The Vapor Car Heating Company, Inc., has moved its Washington, D. C., office from the Munsey building to the Investment building, Fifteenth and K streets, N. W.

H. H. Hale, with headquarters at 75 Freemont Street, San Francisco, Cal., now represents the Gold Car Heating & Lighting Company, Brooklyn, N. Y.

The executive offices of the Gulick-Henderson Company,

Inc., inspecting engineers, matallurgists and chemists, have been moved to 19 West Forty-Fourth street, New York.

HIGGINS & COMPANY has been appointed railway sales representative of the Gardner-Denver Company for the Chicago district and will hereafter handle the full line of railway equipment manufactured by the latter company.

THE THOMSON ELECTRIC WELDING COMPANY, Lynn, Mass., and the Gibb Welding Machines Company, Bay City, Mich., have been consolidated under the name of the Thomson-Gibb Electric Welding Company. Both plants continue in operation.

R. B. TUHEY has been promoted to district representative of the Lincoln Electric Company, Cleveland, Ohio. Mr. Tuhey will have his office in the Peoples Bank building, Indianapolis, Ind. S. H. Taylor has been promoted to district representative at Los Angeles, Cal., with office at 812 Mateo street.

THE LITTLE GIANT PUNCH & SHEAR COMPANY, Sparta, Ill., has disposed of its business to the T. J. Gundlach Machine Company, Belleville, Ill. The Gundlach Company will continue the manufacture and sale of the Little Giant punches and shears and will also be in a position to furnish repairs and extra parts.

FRED SPEER, for the past ten years a mechanical representative of the Gustin-Bacon Manufacturing Company at Philadelphia, Pa., has become associated with the Joseph Dixon Crucible Company, Jersey City, N. J., as a special railroad representative for Dixon railroad products.

JOHN M. HANSEN, chairman of the board of directors of the Standard Steel Car Company and president of the American Railway Car Institute, died suddenly on December 13 at La Rochelle, France, where he was stopping in the course of a European business tour. Mr. Hansen was born in 1873 in Butler county, Pennsylvania, and was graduated from the Western University of Pennsylvania (now the University of Pittsburgh). He first entered the employ of the Schoen Pressed Steel Company as draftsman and later rose to be its chief engineer, When the Schoen Pressed Steel Company was merged into the Pressed Steel Car Company he became chief engineer of the latter and afterwards was assistant to the president. He formed the Standard Steel Car Company in 1902 and became its first president. Later Mr. Hansen relinquished the presidency, but retained the chairmanship of the Standard Steel Car Company board of directors until the time of his death. He was also a director of the Baldwin Locomotive Works.

J. M. Hansen

During the World War, Mr. Hansen made his headquarters in Washington, where he was a member of the Council of National Defense. His work was in connection with the ordering and designing of the 100,000 freight cars for the United States Railroad Administration. He also supervised the designing of the 14,000 freight cars which the United States government sent over to France for the use of the American Expeditionary Forces and was responsible for the equipping of these cars with French type couplers. His foresight in this latter regard was proved, when, at the close of the war, the French government purchased these cars and had them available for immediate use over all the French railroads in connection with pressing reconstruction needs. Had these cars been equipped with American type couplers, France would have been put to the great expense of conversion and subjected to long delays due to the lack of labor and material. In addition, during the war, he continued to supervise the activities of the Standard Steel Car Company which was engaged in building 38,000 railroad cars for the French government, and gun carriage and ammunition for the Allies.

THE BIRD-ARCHER COMPANY, LTD., has been organized with headquarters at Montreal, Que. P. B. Bird is president, L. F. Wilson, senior vice-president; L. G. Calder, vice-president and general manager; C. A. Bird, secretary, and J. Ferguson Smith, treasurer.

R. T. MONAHAN, 812 Oliver street, St. Louis, Mo., has been appointed by the Geometric Tool Company, New Haven, Conn., to handle the sale and servicing of Geometric self-opening die heads, collapsing taps and threading machines in eastern Missouri, southern Illinois and the states of Arkansas and Oklahoma.

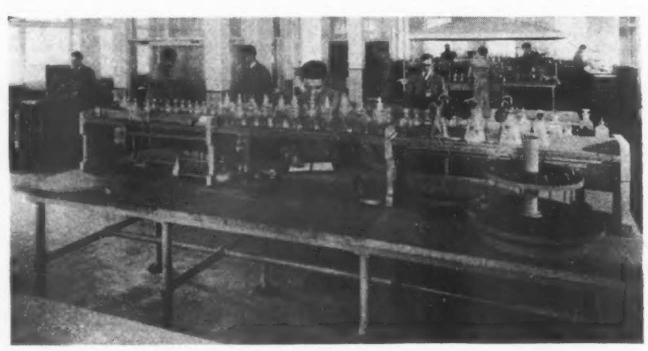
F. A. WHITEHEAD, superintendent of rolling mills has been promoted to the new position of general superintendent at the mills of the Copperweld Steel Company, Glassport, Pa. S. L. Gibason, assistant superintendent of rolling mills, has been appointed superintendent of rolling mills, and J. C. Glover has been appointed assistant superintendent of rolling mills.

ARTHUR C. ALLSHUL, formerly manager of the Buffalo plant of Joseph T. Ryerson & Son, Inc., has been appointed manager of their new unit in the Philadelphia district. Clarence S. Gedney, who has been connected with the specialty sales division of the Ryerson business in the Chicago territory, has been appointed manager of the Buffalo plant to succeed Mr. Allshul.

THE AMERICAN STEEL FOUNDRIES has disposed of its Thurlow plant at Chester, Pa., to the General Steel Castings Corporation in exchange for stock in that company. This plant will, in the future, be operated by the General Steel Castings Corporation, which will probably continue to manufacture approximately the same class of products that has been previously produced at this plant.

THE HARRY W. LEIGHTON COMPANY, Chicago, has been organized by Harry W. Leighton, to act as railroad representative in the Chicago territory for the Buckeye Portable Tool Company, Dayton, Ohio, the Cleveland Steel Tool Company, Cleveland, Ohio, and other industrial accounts. Mr. Leighton, who has represented various companies in Illinois, Indiana, Michigan, Wisconsin and Iowa for the past 15 years, is president of the new company, while W. E. Thurber, who has been manufacturer's representative for the Colonial Tool Steel Company is vice-president and secretary.

THE DEARBORN CHEMICAL COMPANY has completed an addition to its manufacturing plant at Chicago in the form of a new laboratory to be used for research as well as for routine analysis and the factory control work. The new facilities entirely replace and more than double the capacity of the old laboratories. The laboratories occupy an entire floor of the factory and comprise a main room, about 50 ft. wide and 100 ft. long, eight smaller rooms, a library, a storeroom, a receiving room and three offices. The library, about 18 ft. wide and 24 ft. long, contains a large collection of reference works and files of current literature which have been catalogued and card indexed, and it is open to the public.



The laboratory of the Dearborn Chemical Company at Chicago

O. P. Chamberlain, vice-president of the Dolese & Shepard Company, Chicago, and formerly president and general manager of the Chicago & Illinois Western, has been elected president of the Dolese & Shepard Company to succeed J. F. Talbot, president and treasurer. Wm. Roy Carney succeeds Mr. Chamberlain, while Edward R. Hills has been made secretary and Wm. J. Stoffel, treasurer.

Gordon Gordon, secretary of the Taft-Peirce Manufacturing Company, Woonsocket, R. I., has been elected president and treasurer, succeeding Louis V. Hubbard, deceased. Frederick S. Blackall, Jr., who continues as vice-president and general manager in active charge of the plant, assumes also the duties of secretary, succeeding Mr. Gordon who had served in that capacity for the past twenty-five years, and John W. Wheeler, Jr., has been elected to the board of directors.

William K. Farrell, assistant general purchasing agent of the American Locomotive Company, at New York, has been appointed general purchasing agent. In 1903 when Mr. Farrel was just out of high school, he entered the employ of the American Locomotive Company at the Schenectady plant. After a varied experience in different departments at the plant, he was transferred in 1910, to the New York office as one of the buyers in the purchasing department. In 1921, he was appointed assistant general purchasing agent.

Lockwood Hill, for the past ten years a member of the Blackman Hill Company, St. Louis, Mo., has organized a new company to be known as the Hill Equipment Engineering Company with office at 4620 Delmar boulevard, St. Louis. The new organization will have the exclusive sale of the products of the Lincoln Electric Company and the Baker Industrial Truck Company in the St. Louis metropolitan district and the eastern Missouri and southern Illinois territories, and will carry a complete stock of motors and welders, welding supplies, accessories and parts.

A. F. Marwick, formerly general sales manager of the Pettibone-Mulliken Company, has joined the Chicago district sales staff of the Taylor-Wharton Iron & Steel Company and William Wharton, Jr., & Co., Inc. G. V. Wood, formerly located at the Highbridge plant of the Taylor-Wharton Iron & Steel Company, is now western sales manager of Taylor-Wharton and associated companies. Mr. Wood's headquarters will be in San Francisco, Cal. J. R. Van Rensselaer, formerly sales representative of the Taylor-Wharton Company at San Francisco, is now located at the New York office of William Wharton, Jr., & Co.

Floyd K. Smith, for the past 11 years vice-president and treasurer of the Donner Steel Company, Buffalo, N. Y., has been elected president of the company and its subsidiaries, the Donner Steamship Company and the Donner Ore Company succeeding William H. Donner, resigned. Control of the Donner Steel Company was recently acquired by Continental Shares, Inc., Cleveland, Ohio. Mr. Smith has been associated with the iron and steel industry for 35 years. Following his connections with the Republic Iron & Steel Company and various companies, he acquired an interest in the Valley Mould & Iron Company in 1910 where he remained as vice-president until 1918 when he joined the Donner Steel Company. Plans are under way for the merger of the Donner Steel Company and the Witherow Steel Company, Pittsburgh.

The Bethlehem Steel Corporation, through one of its subsidiaries, has entered into agreements covering the acquisition of all the properties and assets of the Pacific Coast Steel Company and the Southern California Iron & Steel Company. The properties to be acquired include steel manufacturing plants located at South San Francisco and Los Angeles, Cal., and Seattle, Wash. The plants have a steel ingot capacity of 380,000 gross tons a year and produce billets, merchant and reinforcing bars, light shapes, plates, rails, tie plates, splice bars, forgings, bolts, nuts and rivets. The properties, when acquired, will be operated through a separate subsidiary company having an active management with headquarters on the Pacific Coast.

Trade Publications

Copies of trade publications described in the column can be obtained by writing to the manufacturers. State the name and number of the bulletin or catalog desired, when mentioned in the description.

Lathes.—The construction of the J & L flat turret lathe and the standard tool outfits supplied with the 2½-in. by 24-in. bar lathe and the 12-in. chuck lathe are described and illustrated in a booklet issued by the Jones & Lamson Machine Company, Springfield, Vt. A second booklet describes the 24-in. Fay automatic lathe which is similar in construction to the Standard Fay automatic lathe. It is built in two types—one for chuck work and the other with a tailstock for work on centers.

Welding Rods.—The Weldite Type-T welding rod for hard surfacing tools and dies for working in metals, rocks and soils is described in detail in Bulletin No. 3 which has been prepared by the Fusion Welding Corporation, Chicago. The Type-T metal with which this welding rod is made is a new alloy which produces a highly wear-resistant surface by either the oxy-acetylene or metallic arc-welding processes.

Portable Test Car.—"The Waugh Portable Test Car" is the title of a booklet just issued by the Waugh Equipment Company, Depew, N. Y., describing the new Waugh portable test car, by the use of which all types of draft gears can be tested without their removal from actual service on freight or passenger equipment. The test car makes a complete record of each gear on a special chart. The exact amount of free slack is recorded, and a characteristic performance curve shows the exact travel and release of the gear up to the capacity of the test car. With this car it is estimated that an average of fifty gears a day can be tested.

Annual Report of Director of the Bureau of Standards.—The Annual Report of the Director of the Bureau of Standards to the Secretary of Commerce for the fiscal year ended June 30, 1929, is contained in Miscellaneous Publication No. 102, which can be obtained at a price of ten cents from the Superintendent of Documents, Washington, D. C. The report covers the general activities of the Bureau and outlines the various outstanding accomplishments, grouped according to subjects, for which specific appropriations had been made by Congress. Among the subjects covered in these appropriations were the testing of structural materials, testing machines, standardizing mechanical applications, gage standardization, metallurgical research, high-temperature investigation, testing railroad-track and other scales, standardization of equipment, investigation of automotive engines, etc.

Screw-Thread Tables for Shop Use.—Miscellaneous publications, Nos. 98 and 99, of the Bureau of Standards, United States Department of Commerce, Washington, D. C., contain American National screw-thread tables for shop use. Publication No. 98 makes available for convenient use six of the most essential tables of dimensions of fastening screws as published in the 1928 report of the National Screw Thread Commission, covering the basic sizes, limiting dimensions, tolerances and tap-drill sizes for the American National coarse and fine thread series. Publication No. 99 presents in compact form the tables of dimensions of special screw threads having the American National form of thread (60 deg.) as published in the 1928 report of the commission, covering the basic sizes, limiting dimensions and tolerances for the American National 12-pitch thread services and other screw threads of special diameters, pitches and lengths of engagement. These publications can be obtained from the Superintendent of Documents, Washington, at a cost of 10 cents each.

Personal Mention

General

Frank Williams, mechanical engineer of the Canadian National at Moncton, N. B., has been transferred to Montreal, Que.

Kirby M. Post, superintendent of the St. Louis Southwestern lines in Texas, with headquarters at Tyler, Tex., has been promoted to assistant to the president with headquarters at St. Louis, Mo.

Guy H. Pratt has been appointed general air brake inspector of the Oregon-Washington Railroad & Navigation Company, with headquarters at Portland, Ore., succeeding J. C. Shea, deceased.

Taber Hamilton, general agent and superintendent of the Grand Rapids division of the Pennsylvania, with headquarters at Grand Rapids, Mich., has been appointed engineer of motive power in the office of the chief engineer of motive power, with headquarters at Philadelphia, Pa.

E. Betts, assistant engineer of standards of the Southern Pacific, has been appointed inspection engineer, with headquarters as before at San Francisco, Cal. Mr. Betts will have charge of the inspection of new material and new equipment in addition to other duties to which he may be assigned.

Charles W. Esch, who has been promoted to mechanical engineer of the Chicago & Alton, with headquarters at Bloomington, Ill., has been connected with the mechanical departments of various railways in the west for about 14 years. He was born at Peru, Ind., on January 26, 1901, and graduated from the Decatur (Ill.) high school in 1918. Later Mr. Esch attended James Millikin University. During vacations he was engaged by the Wabash at Decatur as a boiler maker's helper, as a machinist's helper and later as an A. R. A. clerk in the car department. Following a year in a college engineering course he entered the drawing room of the mechanical department of the Wabash as a draftsman in 1920. Four years later he became a locomotive draftsman on the Union Pacific and in 1925 he was employed in a similar capacity by the Texas & Pacific, where he also conducted tests on forced drafts for locomotives. Mr. Esch entered the service of the Chicago & Alton as chief draftsman in the mechanical department at Bloomington in 1926, a position he held until his recent promotion to mechanical engineer.


Charles W. Esch

Shop and Enginehouse

A. Mihleisen has been appointed general inspector of boilers of the Atchison, Topeka & Santa Fe, with headquarters at Topeka, Kan., succeeding George Austin, who has retired from active duty after 54 years of railway service, 27 of which were with the Santa Fe. Mr. Austin has been general boiler inspector since 1906.

F. Colburn, enginehouse foreman of the Missouri Pacific at St. Louis, Mo., has been promoted to the position of general foreman, with headquarters at Poplar Bluff, Mo.

Grant McLean, in the employ of the Canadian National as a machinist at Halifax, N. C., has been appointed locomotive foreman, with headquarters at Dartmouth, N. S.

W. F. Miller, formerly machine shop foreman at the Oaklawn shops of the Chicago & Eastern Illinois, Danville, Ill., has been promoted to the position of general foreman of the locomotive department in the place of Robert E. Bannin, deceased.

Master Mechanics and Road Foremen

The jurisdiction of L. H. Kuhn, master mechanic of the Tennessee division of the Illinois Central at Jackson, Tenn., has been extended to include the Kentucky division.

Claude M. Starke, master mechanic of the Kentucky division of the Illinois Central at Paducah Ky., has been transferred to the Chicago Terminal division, with headquarters at Chicago.

N. Bell, master mechanic of the Iowa division of the Illinois Central at Waterloo, Iowa, has been promoted to general master mechanic of the Iowa. Minnesota and Wisconsin divisions, with headquarters in the same city.

R. R. Royal, general foreman of the locomotive department of the Illinois Central at Paducah, Ky., has been promoted to master mechanic of the Paducah shop, with headquarters in the same city.

H. L. Needham, master mechanic at the Chicago Terminal of the Illinois Central, has been promoted to general master mechanic of the Chicago Terminal, Illinois, Springfield and Indiana divisions, with headquarters as before at Sixty-third street, Chicago.

Car Department

H. S. Ake, car repairman, Middle Division, Pennsylvania, has been promoted to the position of gang foreman, with headquarters at the Lucknow, Pa., car shops.

D. P. Perry, assistant car foreman of the Texas & Pacific at Texarkana, Ark., has been transferred to Shreveport, La., as assistant car foreman at that point.

The title of A. J. Pichetto, assistant general air brake, lubrication and car heating engineer of the Illinois Central, has been changed to air brake, lubrication and car heating engineer.

Lee Helm, gang foreman of the Missouri Pacific at Kansas City, Mo., has been promoted to the position of freight car foreman.

F. C. Baldwin, foreman carpenter of the Pennsylvania, Maryland division, has been promoted to the position of assistant master carpenter, Philadelphia Terminal division.

F. D. Philipp, a carman for the St. Joseph & Grand Island at St. Joseph, Mo., has been promoted to the position of car foreman, with headquarters at the same city.

J. N. Davis, master carpenter of the Tyrone division of the Pennsylvania, has been appointed master carpenter of the Cumberland Valley division.